DEVELOPING A STATE WATER PLAN

GROUND-WATER CONDITIONS IN UTAH, SPRING OF 1988

by

Gail E. Cordy and others

United States Geological Survey

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in cooperation with the State of Utah

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CONVERSION FACTORS

Most values in this report are given in inch-pound units. Conversion factors to metric units are shown below.

Multiply	by	To obtain
Acre-foot	1233	Cubic meter
Foot	0.3048	Meter
Inch	25.40	Millimeter
Mile	1.609	Kilometer

Chemical concentration is given only in metric units--milligrams per liter. For concentrations less than 7,000 milligrams per liter, the numerical value is about the same as for concentrations in parts per million.

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INTRODUCTION

This is the twenty-fifth in a series of annual reports that describe ground-water conditions in Utah. Reports in the series, published cooperatively by the U.S. Geological Survey and the Utah Division of Water Resources, provide data to enable interested parties to keep abreast of changing ground-water conditions.

This report, like the others in the series, contains information on well construction, ground-water withdrawals from wells, water-level changes, and related changes in precipitation and streamflow. Supplementary data such as graphs showing chemical quality of water and maps showing water-level contours are included in reports of this series only for those years or areas for which applicable data are available and are important to a discussion of changing ground-water conditions.

The report includes individual discussions of selected major areas of ground-water development in the State for the calendar year 1987. Water-level fluctuations, however, are described for the period from the spring of 1987 to the spring of 1988. Much of the data used in the report were collected by the Geological Survey in cooperation with the Division of Water Rights, Utah Department of Natural Resources.

The following reports dealing with ground water in the State were released or printed by the Geological Survey or cooperating agencies during 1987:

Selected hydrologic and physical properties of Mesozoic formations in the Upper Colorado River Basin in Arizona, Colorado, Utah, and Wyoming--Excluding the San Juan Basin, Jay F. Weigel, U.S. Geological Survey Water-Resources Investigations Report 86-4170.

Hydrology of Alkali Creek and Castle Valley Ridge coal-lease tracts, central Utah, R. L. Seiler and R. L. Baskin, U.S. Geological Survey Water-Resources Investigations Report 87-4186.

Selected water-level data for Mesozoic formations in the Upper Colorado River Basin, Arizona, Colorado, Utah, and Wyoming--excluding the San Juan Basin, Jay F. Weigel, U.S. Geological Survey Open-File Report No. 87-397.

Ground-water conditions in Salt Lake Valley, Utah, 1969-83, and predicted effects of increased withdrawals from wells, K. M. Waddell, R. L. Seiler, M. Santini, and D. K. Solomon, Utah Department of Natural Resources Technical Publication No. 87.

Chemical quality of ground water in Salt Lake Valley, Utah, 1969-84, K. M. Waddell, R. L. Seiler, and D. K. Solomon, Utah Department of Natural Resources Technical Publication No. 89.

Seepage study of a 15.3-mile section of the Central Utah Canal, Pahvant Valley, Millard County, Utah, Michael Enright, Utah Department of Natural Resources Technical Publication No. 91.

The base of moderately saline water in the Uinta Basin, Utah, Lewis Howells, M. S. Longson, and G. L. Hunt, Utah Department of Natural Resources Technical Publication No. 92.

Ground-water conditions in Utah, spring of 1987, Dale E. Wilberg and others, Utah Division of Water Resources Cooperative Investigations Report 27.

Utah ground-water quality, K. M. Waddell, U.S. Geological Survey Open-File Report No. 87-0757, to be part of National Water Summary, 1986, U.S. Geological Survey Water-Supply Paper 2350.

Hydrology of Area 57, Northern Great Plains and Rocky Mountain Coal Provinces, Utah and Arizona, Don Price and others, U.S. Geological Survey Water-Resources Investigations Report 84-068.

Ground water in the southeastern Uinta Basin, Utah and Colorado, W. F. Holmes and B. A. Kimball, U.S. Geological Survey Water-Supply Paper 2248.

UTAH'S GROUND-WATER RESERVOIRS

Small quantities of ground water can be obtained from wells throughout much of Utah, but large supplies that are of suitable chemical quality for irrigation, public supply, or industrial use generally can be obtained only in specific areas. The major areas of ground-water development discussed in this report are shown in figure 1 and named in table 1. Relatively few wells outside of these areas yield large supplies of water of good chemical quality for the uses listed above, although some of the basins in western Utah and many areas in eastern Utah have not been explored sufficiently to determine their potential for ground-water development.

About 2 percent of the wells in Utah obtain water from consolidated rocks. The consolidated rocks that yield the most water are lava flows, such as basalt, which contain interconnected vesicular openings, fractures, or permeable weathered zones at the tops of flows; limestone, which contains fractures or other openings enlarged by solution; and sandstone, which contains open fractures. Most of the wells that tap consolidated rocks are in the eastern and southern parts of the State in areas where water supplies cannot be obtained readily from unconsolidated deposits.

About 98 percent of the wells in Utah draw water from unconsolidated deposits. These deposits may consist of boulders, gravel, sand, silt, or clay, or a mixture of some or all of these materials. Wells obtain the largest yields from the coarser materials that are sorted into deposits of uniform grain size. Most wells that tap unconsolidated deposits are in large intermountain basins, which have been partly filled with rock material eroded from the adjacent mountains.

SUMMARY OF CONDITIONS

The estimated total withdrawal of water from wells in Utah during 1987 was about 779,000 acre-feet, which is about 91,000 acre-feet, or 13 percent, more than the estimate for 1986 and about 21,000 acre-feet, or 3 percent, more than the average annual withdrawal for 1977-86 (table 2). The increase in withdrawal was predominantly for irrigation and public supply. Withdrawal for irrigation was about 435,000 acre-feet (table 2), which is 42,000 acre-feet, or 11 percent, more than the estimate for 1986. Public supply withdrawal was about 197,000 acre-feet, an increase of 37,000 acre-feet, or 23 percent, from 1986. Withdrawal for industrial use was 79,000 acre-feet, which is about 8,000 acre-feet, or 11 percent, more than the 1986 estimate. Withdrawal for domestic and stock use, about 65,000 acre-feet, increased by about 1,000 acre-feet from the 1986 estimated value.

Of the 16 major areas referred to in this report (table 2), only Parowan Valley and the Milford area showed decreases in ground-water withdrawals in 1987. Withdrawals in the upper and central Sevier Valleys and the upper Fremont River valley equalled 1986 estimates. Withdrawals in 7 of the 16 areas exceeded the 1977-86 annual average for each area, and withdrawals were less than or equal to the average in the remaining 9 areas (table 2).

The quantity of water withdrawn from wells is related to demand and availability of water from other sources, which in turn are related to

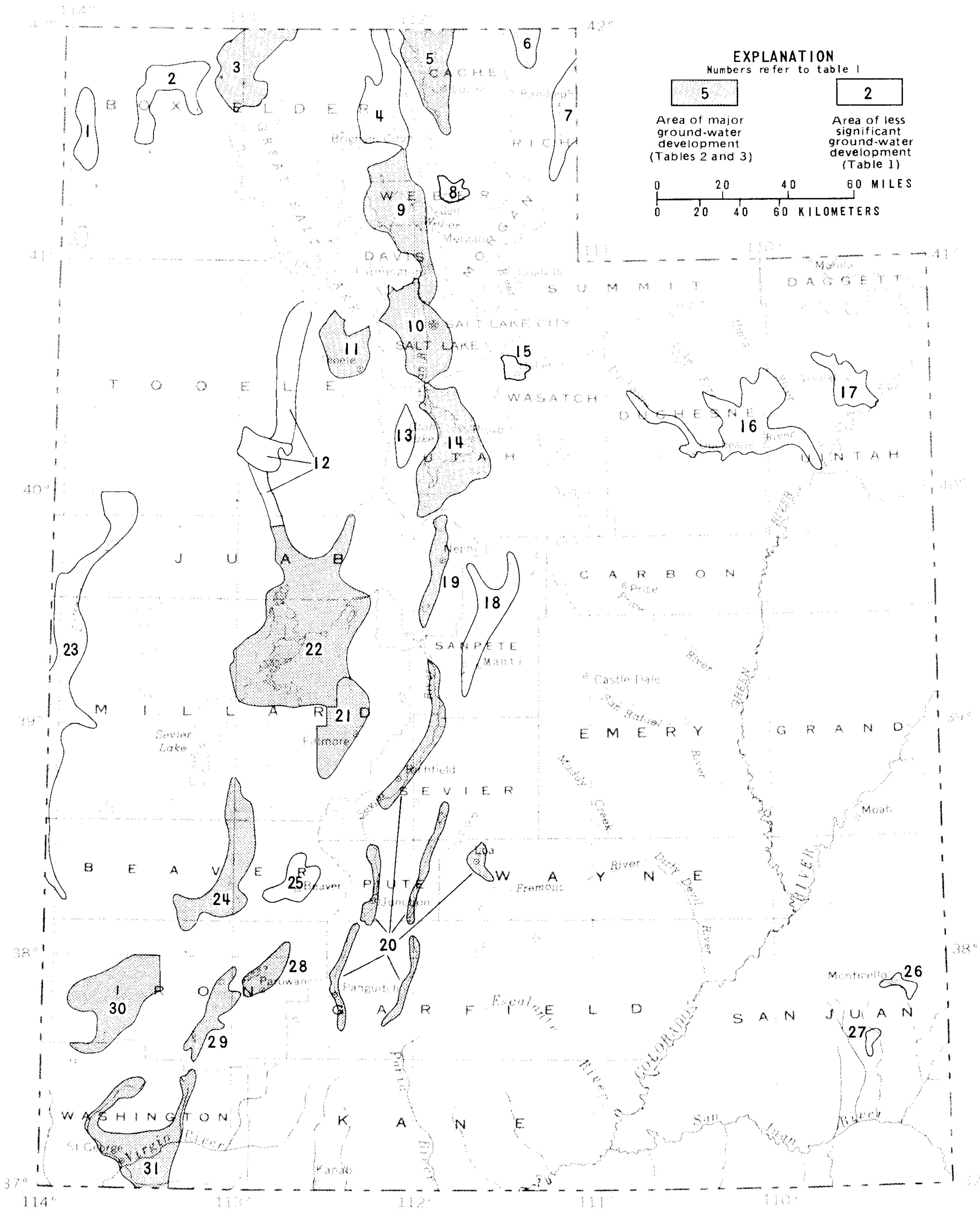

Figure 1.—Areas of ground-water development specifically referred to in this report.

Table 1.—Areas of ground-water development in Utah specifically referred to in this report

Number in figure 1	Area	Principal type of water-bearing rocks
1	Grouse Creek Valley	Unconsolidated
2	Park Valley	Do.
3	Curlew Valley	Unconsolidated and consolidated
4	Malad-lower Bear River valley	Unconsolidated
5	Cache Valley	Do.
6	Bear Lake valley	Do.
7	Upper Bear River valley	Do.
8	Ogden Valley	Do.
9	East Shore area	Do.
10	Salt Lake Valley	Do.
11	Tooele Valley	Do.
12	Dugway area	Do.
	Skull Valley	Do.
	Old River Bed	Do.
13	Cedar Valley, Utah County	Do.
14	Utah and Goshen Valleys	Do.
15	Heber Valley	Do.
16	Duchesne River area	Unconsolidated and consolidated
17	Vernal area	Do.
18	Sanpete Valley	Do.
19	Juab Valley	Unconsolidated
20	Central Sevier Valley	Do.
	Upper Sevier Valleys	Do.
	Upper Fremont River valley	Unconsolidated and consolidated
21	Pahvant Valley	Do.
22	Sevier Desert	Unconsolidated
23	Snake Valley	Do.
24	Milford area	Do.
25	Beaver Valley	Do.
26	Monticello area	Consolidated
27	Blanding area	Do.
28	Parowan Valley	Unconsolidated and consolidated
29	Cedar Valley, Iron County	Unconsolidated
30	Beryl-Enterprise area	Do.
31	Central Virgin River area	Unconsolidated and consolidated

local climatic conditions. This was the sixth consecutive year of generally above-average precipitation in Utah, although above-average precipitation was not so widespread as in the preceding 5 years. Graphs and bar charts in this report show cumulative departure from average annual precipitation at 33 weather stations throughout Utah. Of the 33 stations, 20 stations recorded departures above the average annual value. Most of the stations in southwestern and southeastern Utah had above-average precipitation with the largest positive departure, about 6 inches, recorded at Blanding.

Below-average precipitation was recorded at 13 stations, largely in the valleys of central Utah and along the Wasatch Range from Salt Lake City to Logan. The largest negative departures, about 8 inches, were recorded at Pine View Dam and Silver Lake near Brighton.

Measurements of water levels in 776 wells during February and March 1988 indicate that water levels declined in about 80 percent of the wells when compared with measurements for a similar period in 1986. Declines were noted in more than 90 percent of the wells surveyed in Salt Lake, Tooele, Cache, and Juab Valleys, as well as the East Shore and Beryl-Enterprise areas. Water-level declines in these and other areas of the State are probably the result of decreased precipitation in 1987 as compared to 1986 and increased ground-water withdrawal for public supply, irrigation, and industrial use.

Water-level rises were measured in about 40 percent of the wells in the survey in Pahvant, Curlew, and Cedar (Iron Co.) Valleys, the central Virgin River area, the shallow artesian aquifer in Sevier Desert, and the water-table aquifer in Utah and Goshen Valleys. Rises in water levels in these and other areas are probably related to local decreases in pumping due to the availability of greater supplies of surface water in 1987 as compared to 1986 resulting from precipitation that was greater in 1987 than in 1986, or to increases in recharge that were also related to more precipitation in 1987 than in 1986.

The total number of wells drilled during 1987 (table 2), taken from reports by well drillers filed with the Utah Division of Water Rights, was about 10 percent more than the number reported for 1986. Of the 543 wells drilled in 1987, 159 were for new appropriations of ground water, 98 were replacement wells, and the remaining 286 wells include test and monitoring wells. Thirty large-diameter wells, 12 inches or more in diameter, were drilled in 1987 mostly for public supply, irrigation, and industrial use.

The large ground-water basins and those that have experienced most of the ground-water development in Utah are shown in figure 1. Information about the number of wells constructed, withdrawals of water from wells for principal uses, and total withdrawals during 1987 for the major areas of ground-water development is presented in table 2. Annual withdrawals from the major areas of ground-water development for 1977-86 are shown in table 3.

Table 2.--Well construction and withdrawal of water from wells in Utah

Number of wells constructed in 1987.--Data provided by Utah Department of Natural Resources, Division of Water Rights. Includes test wells and replacement wells.
Diameter of 12 inches or more.--Constructed for irrigation, industry, or public supply.
Estimated withdrawals from wells.--
1986 total: From Wilberg and others (1987, table 2).
1977-86 average annual: Calculated from previous reports of this series and also includes some previously unpublished revisions.

Area	Number in figure 1	Number of wells constructed in 1987: Total	Number of wells constructed in 1987: Diameter of 12 inches or more	Estimated withdrawals from wells (acre-feet), 1987: Irrigation	1987: Industry	1987: Public supply	1987: Domestic and stock	1987: Total (rounded)	1986 total	1977-86 average annual
Curlew Valley	3	1	0	28,500	0	20	50	29,000	26,000	27,000
Cache Valley	5	30	0	12,700	7,700	3,350	1,800	26,000	23,000	26,000
East Shore area	9	49	3	(1)25,700	9,000	28,000	4,000	67,000	66,000	47,000
Salt Lake Valley	10	110	4	3,060	(2)11,000	83,000	25,300	122,000	104,000	116,000
Tooele Valley	11	32	1	(1)18,100	1,200	2,400	250	22,000	21,000	26,000
Utah and Goshen Valleys	14	33	2	47,100	5,300	31,000	20,000	103,000	75,000	92,000
Juab Valley	19	4	0	20,400	0	(4)1,400	300	22,000	10,000	15,000
Sevier Desert	22	15	0	10,300	2,600	1,400	300	15,000	11,000	22,000
Upper and central Sevier Valleys and upper Fremont River valley	20	24	2	11,500	300	4,600	5,500	22,000	22,000	24,000
Pahvant Valley	21	0	0	65,000	100	430	300	66,000	60,000	(3)70,000
Cedar Valley, Iron County	29	11	1	17,000	700	2,600	500	21,000	19,000	27,000
Parowan Valley	28	4	0	(5)20,400	300	670	200	22,000	24,000	26,000
Escalante Valley										
Milford area	24	2	0	36,500	(6)6,000	750	250	44,000	46,000	52,000
Beryl-Enterprise area	30	9	7	72,900	(7)23,100	420	750	97,000	93,000	87,000
Central Virgin River area	31	8	1	7,400	1,600	10,500	250	20,000	20,000	20,000
Other areas (8)		211	9	38,600	10,500	20,600	5,200	75,000	68,000	81,000
Totals (rounded)		(9)543	30	435,000	79,000	191,000	65,000	773,000	688,000	758,000

(1) Includes some domestic and stock use.
(2) Includes some use for air conditioning, about 30 percent of which is reinjected into the aquifer.
(3) Previously unreported revision.
(4) Includes some industrial use.
(5) Includes some use for stock.
(6) Withdrawal for geothermal power generation. Approximately 5,500 acre-feet was reinjected.
(7) Includes 23,000 acre-feet pumped to dewater a mine and used as recharge in adjacent area.
(8) Withdrawals are estimated minimum. See page 70 for withdrawal estimates for other areas.
(9) Includes 159 withdrawal wells and 98 replacement wells. Data from Division of Water Rights, Utah Department of Natural Resources.

Table 3.--Total annual withdrawal of water from wells in major areas of ground-water developement in Utah, 1977-86

[From previous reports of this series.]

Area	Number in figure 1	Thousands of acre-feet 1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Curlew Valley	3	31	27	29	30	40	26	18	20	27	26
Cache Valley	5	32	26	28	25	33	26	20	21	22	23
East Shore area	9	48	36	46	45	36	38	43	49	67	66
Salt Lake Valley	10	113	120	125	129	127	115	110	102	110	104
Tooele Valley	11	28	30	30	27	30	26	22	23	22	21
Utah and Goshen Valleys	14	118	104	107	94	101	86	74	78	88	75
Juab Valley	19	29	19	21	15	21	16	6	6	11	10
Sevier Desert	22	50	40	45	13	18	16	8	10	13	
Upper and central Sevier Valleys and upper Fremont River valley	20	26	26	24	24	25	28	21	20	21	22
Pahvant Valley	21	(1) 96	(1) 79	(1) 85	(1) 77	(1) 83	(1) 70	42	42	(1) 62	60
Cedar Valley, Iron County	29	40	31	32	28	29	28	21	20	23	19
Parowan Valley	28	33	29	30	28	27	25	22	22	25	24
Escalante Valley											
Milford area	24	65	58	49	61	69	55	39	32	49	46
Beryl-Enterprise area	30	81	71	79	71	93	99	86	95	100	93
Central Virgin River area (2)	31	18	20	20	20	22	27	16	19	21	20
Other areas		108	92	92	70	83	100	52	64	77	68
Totals		(1) 916	(1) 808	(1) 842	(1) 757	(1) 837	(1) 781	600	623	(1) 738	688

(1) Previously unpublished revision

(2) Prior to 1984 included under 'Other Areas'

MAJOR AREAS OF GROUND-WATER DEVELOPMENT

CURLEW VALLEY

by G. J. Smith

Withdrawal of water from wells in Curlew Valley in 1987 was approximately 29,000 acre-feet, an increase of about 3,000 acre-feet from the amount reported for 1986 and 2,000 acre-feet more than the average during 1977-1986 (table 2).

Water levels in Curlew Valley generally declined from March 1987 to March 1988 (fig. 2). The declines probably were due to increased withdrawals for irrigation. The rises in water levels in the northeastern, north-central, and southwestern parts of the valley may be due to increased precipitation in 1987 or to local decreases in withdrawals. Precipitation at Snowville in 1987 was 14.45 inches, which is 1.87 inches above the average annual precipitation during 1941 through 1987.

The relation of water levels in two selected observation wells to cumulative departure from average annual precipitation at Snowville and to annual withdrawals from wells is shown in figure 3. The hydrograph for well (B-14-9)7bbb-1, located in the irrigated area west of Snowville, shows a general decline in water levels from 1962 to 1982, and a general rise from 1982 to 1988. Well (B-12-11)16cdc-1 is on the edge of the irrigated area near Kelton. The hydrograph of this well shows a declining trend from 1954 to 1982, followed by a general rise since 1982. Long-term water-level changes in these two wells likely are related to increases in withdrawals of ground water during 1963-81, a decline in withdrawals during 1982-84, and above-normal precipitation during 1982-84.

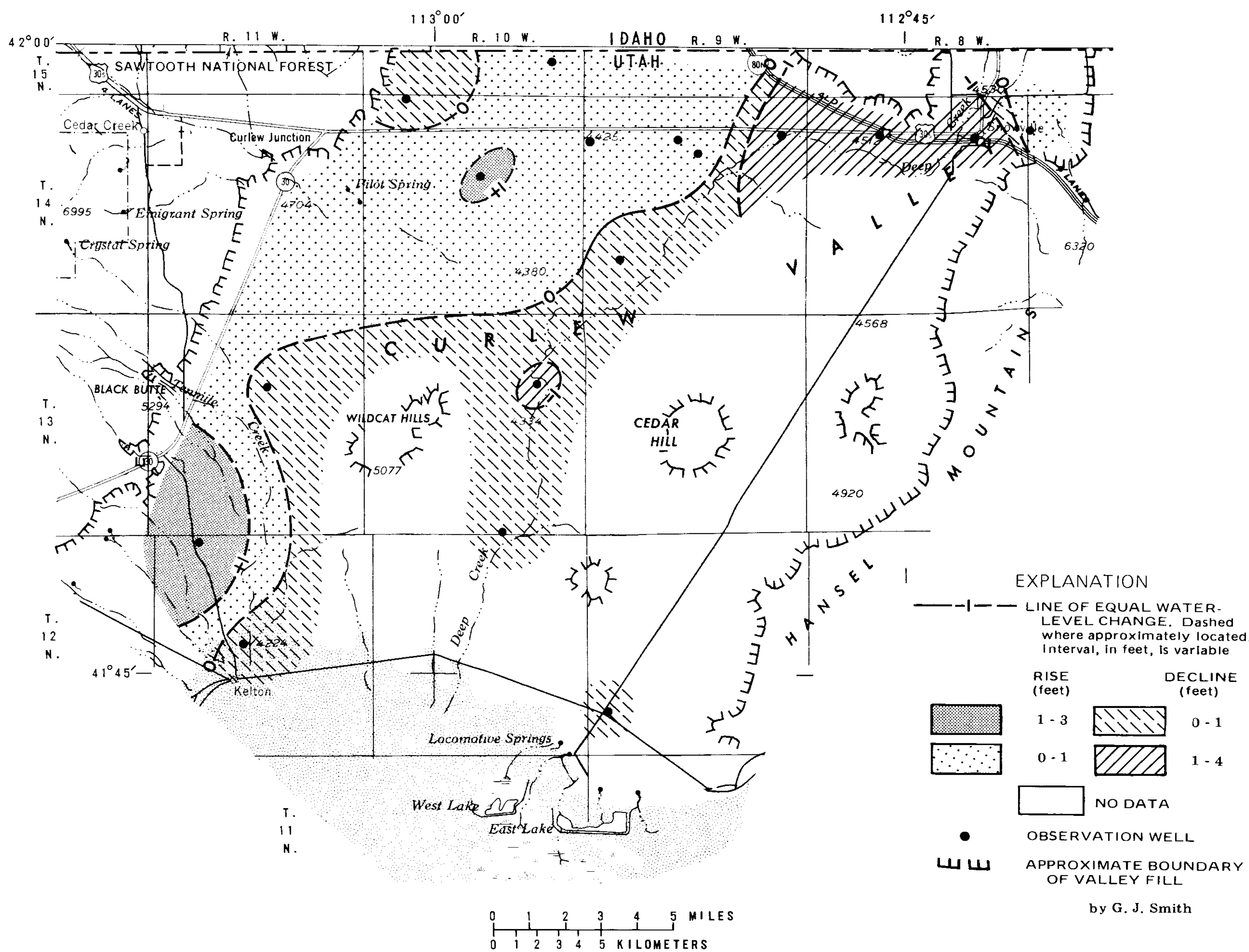

Figure 2.- Map of Curlew Valley showing change of water levels from March 1987 to March 1988.

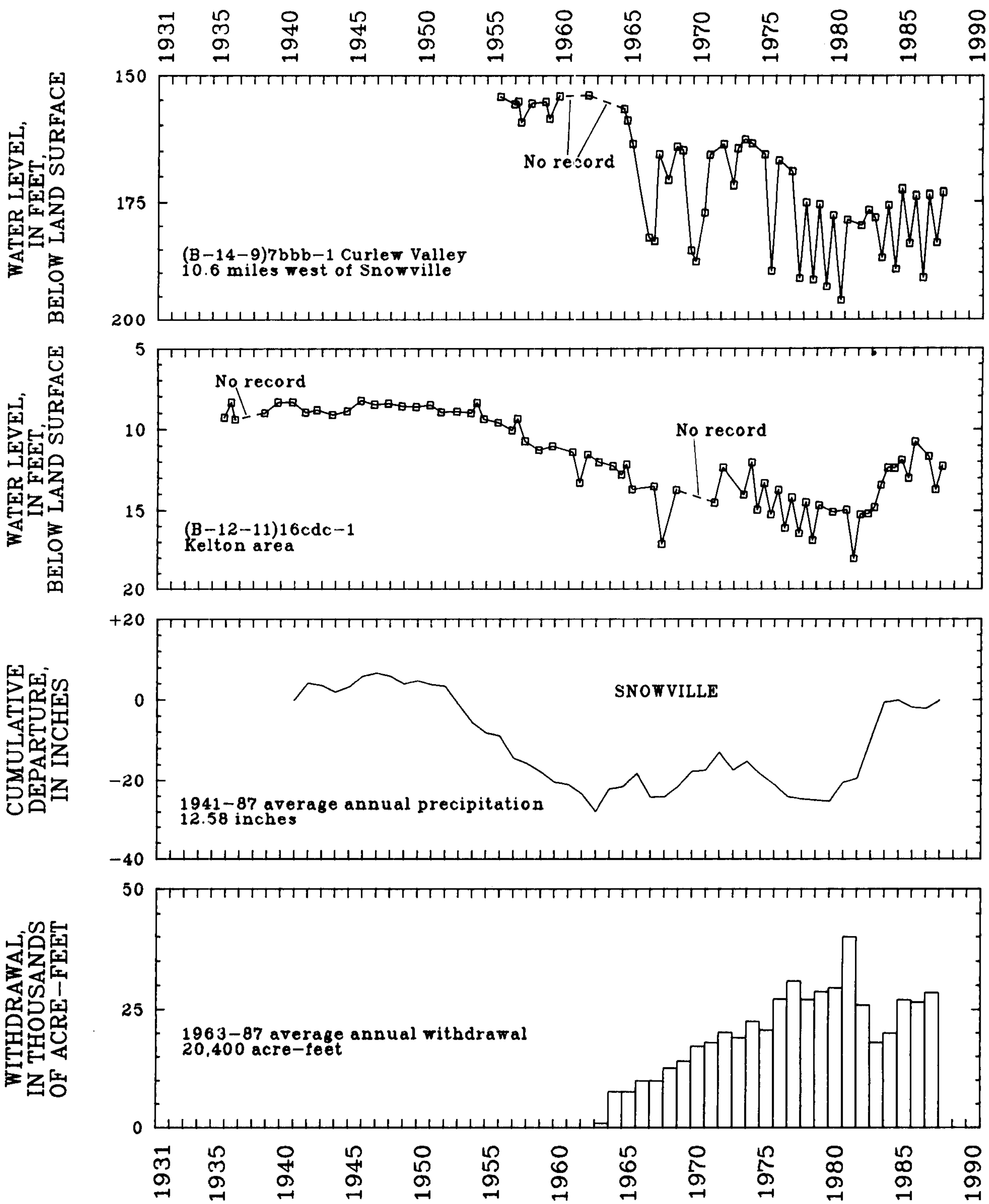

Figure 3.—Relation of water levels in selected wells in Curlew Valley to cumulative departure from the average annual precipitation at Snowville and to annual withdrawals from wells.

CACHE VALLEY

By D. Michael Roark

Approximately 26,000 acre-feet of water was withdrawn from wells in Cache Valley in 1987. This was 3,000 acre-feet more than the amount withdrawn in 1986 and equal to the average annual withdrawal for the period 1977-86 (table 2). The increased withdrawal in 1987 was due to a greater use of well water for public supply and irrigation. Discharge of the Logan River during 1987 was 105,200 acre-feet, which is 226,100 acre-feet less than 1986 and 56 percent of the 1941-87 average annual discharge of 186,500.

Water levels from March 1987 to March 1988 generally declined throughout Cache Valley, with small increases occurring around Mendon and in the northwestern part of the valley. The greatest declines occurred on the east side of the valley near the mountain front (fig. 4), which generally coincides with the recharge area for the basin-fill aquifer. The annual precipitation of 17.23 inches in 1987 was 1.70 inches below the 1941-87 average, probably resulting in below-average recharge which contributed to the decline in water levels. The long-term trend of the water level in well (A-12-1)29cab-1, the annual discharge of the Logan River near Logan, the cumulative departure from the annual precipitation at Logan, Utah State University, and the annual withdrawals for wells are shown in figure 5.

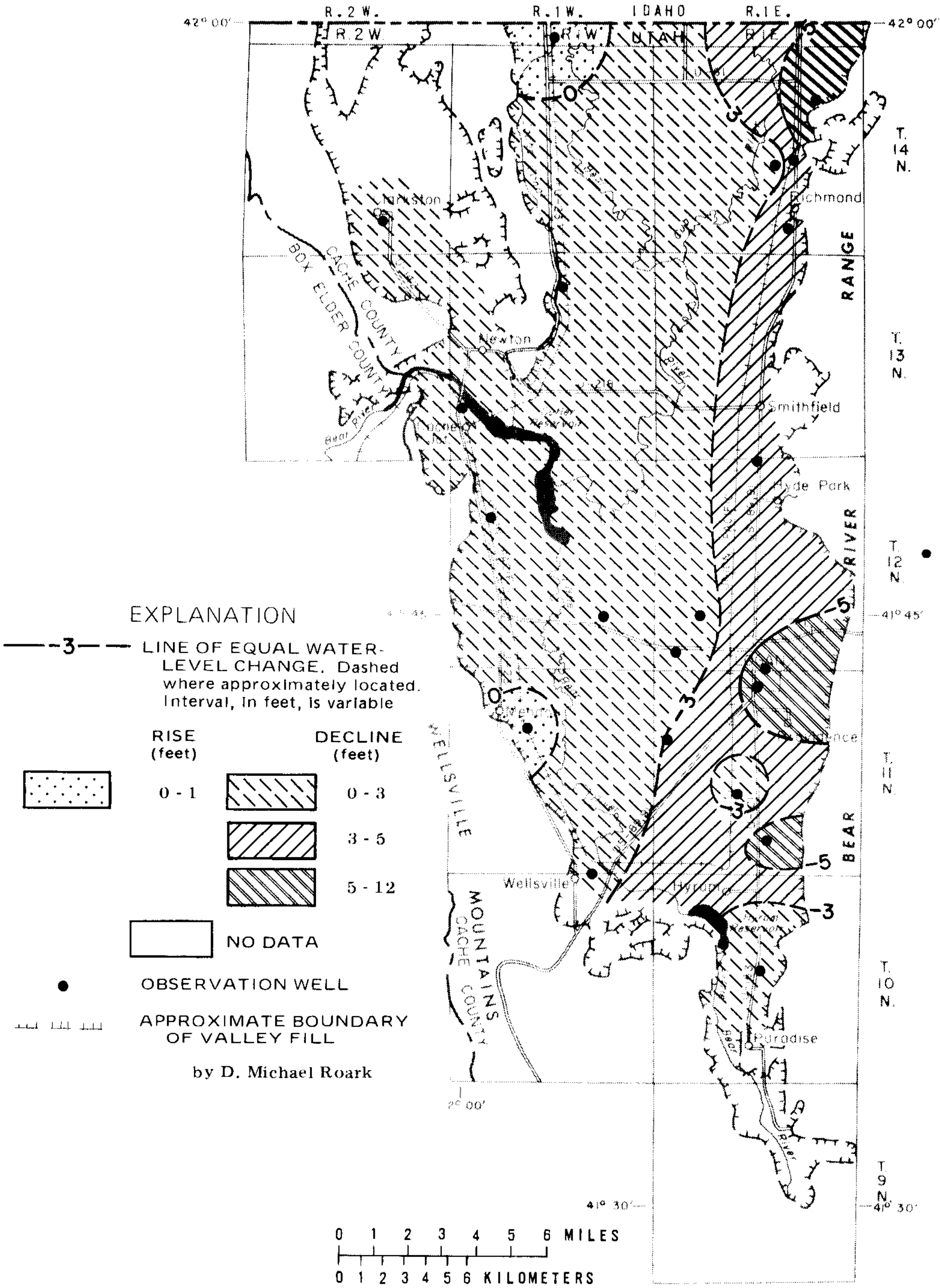

Figure 4.—Map of Cache Valley showing change of water levels from March 1987 to March 1988.

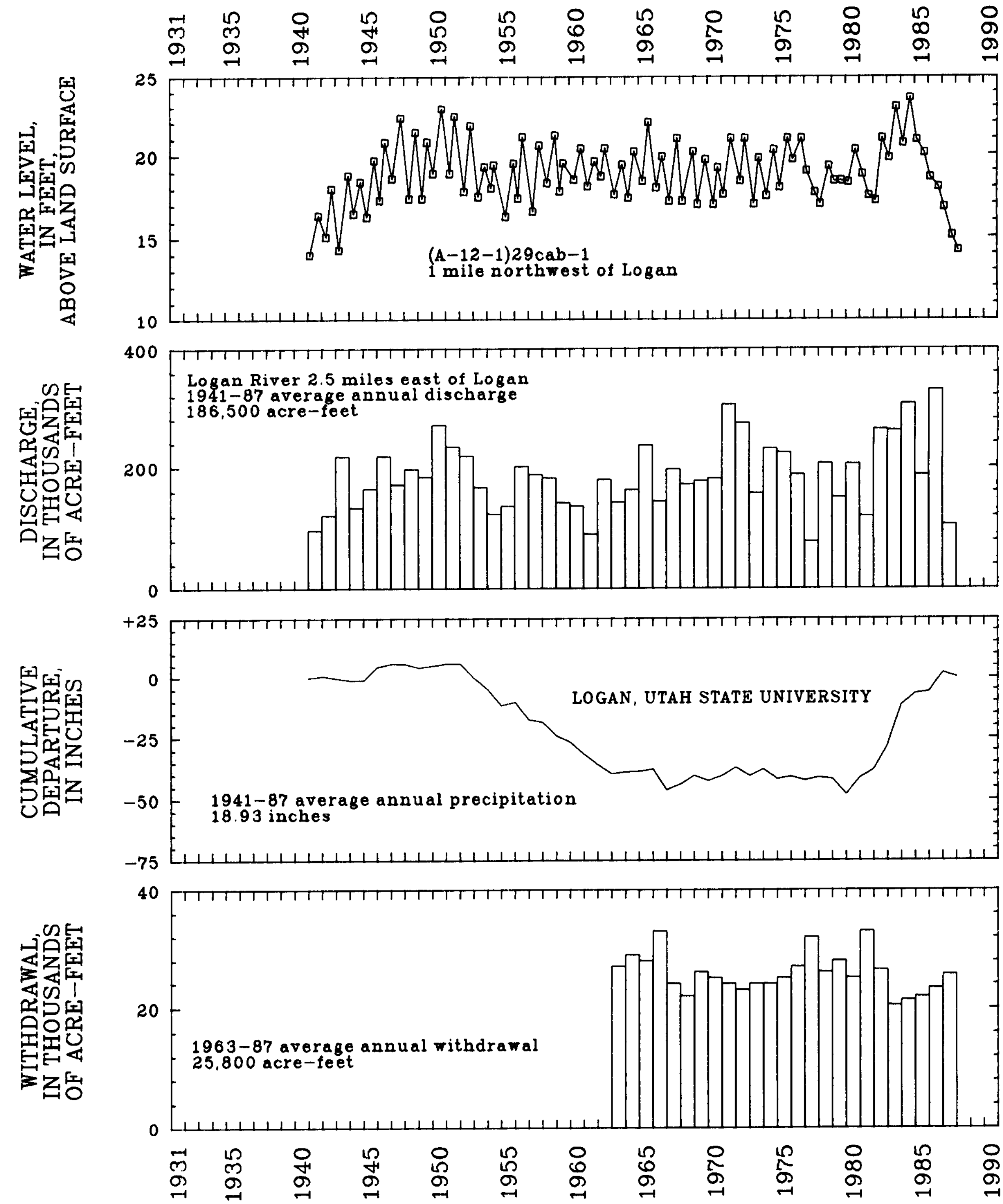

Figure 5.—Relation of water levels in well (A-12-1)29cab-1 in Cache Valley to discharge of the Logan River near Logan, to cumulative departure from the average annual precipitation at Logan, Utah State University, and to annual withdrawals from wells.

EAST SHORE AREA

by Patrick M. Lambert

Withdrawal of water from wells in the East Shore area in 1987 was about 67,000 acre-feet, 1,000 acre-feet more than reported for 1986 (table 2). Estimated withdrawal for irrigation increased about 2,900 acre-feet from 1986, due mainly to an increase in discharge from flowing wells. Estimated withdrawal for industry, public supply, and domestic use did not change significantly from 1986.

Water levels declined in most of the East Shore area from March 1987 to March 1988 (fig. 6) due to less than normal recharge from below-average precipitation. General declines of 5 to 12 feet occurred along the eastern side of the area near the Wasatch Range, which is the recharge area for the principal aquifers. Declines of 12 to 26 feet occurred locally in the Ogden area, and water levels declined or rose only slightly in the western part of the area.

The relation of water levels in selected observation wells to precipitation at the Ogden Pioneer Powerhouse and ground-water withdrawal from wells is shown in figure 7. The 1987 precipitation at the Ogden Pioneer Powerhouse was 17.41 inches, 4.32 inches less than the 1937-87 average annual precipitation. Water-level declines in the observation wells reflect the effects of the below-average precipitation and resulting lower streamflow and recharge.

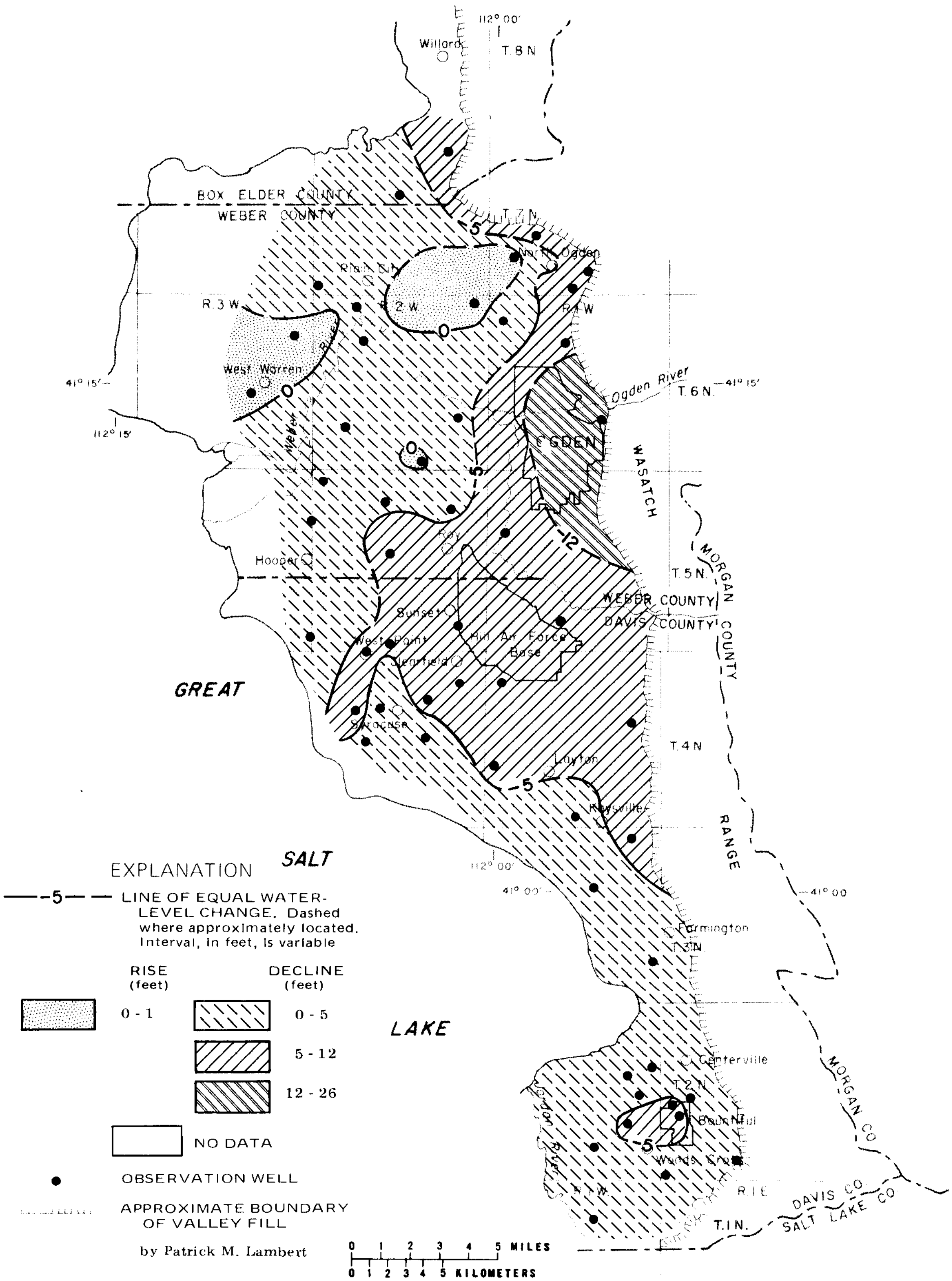

Figure 6.—Map of the East Shore area showing change of water levels from March 1987 to March 1988.

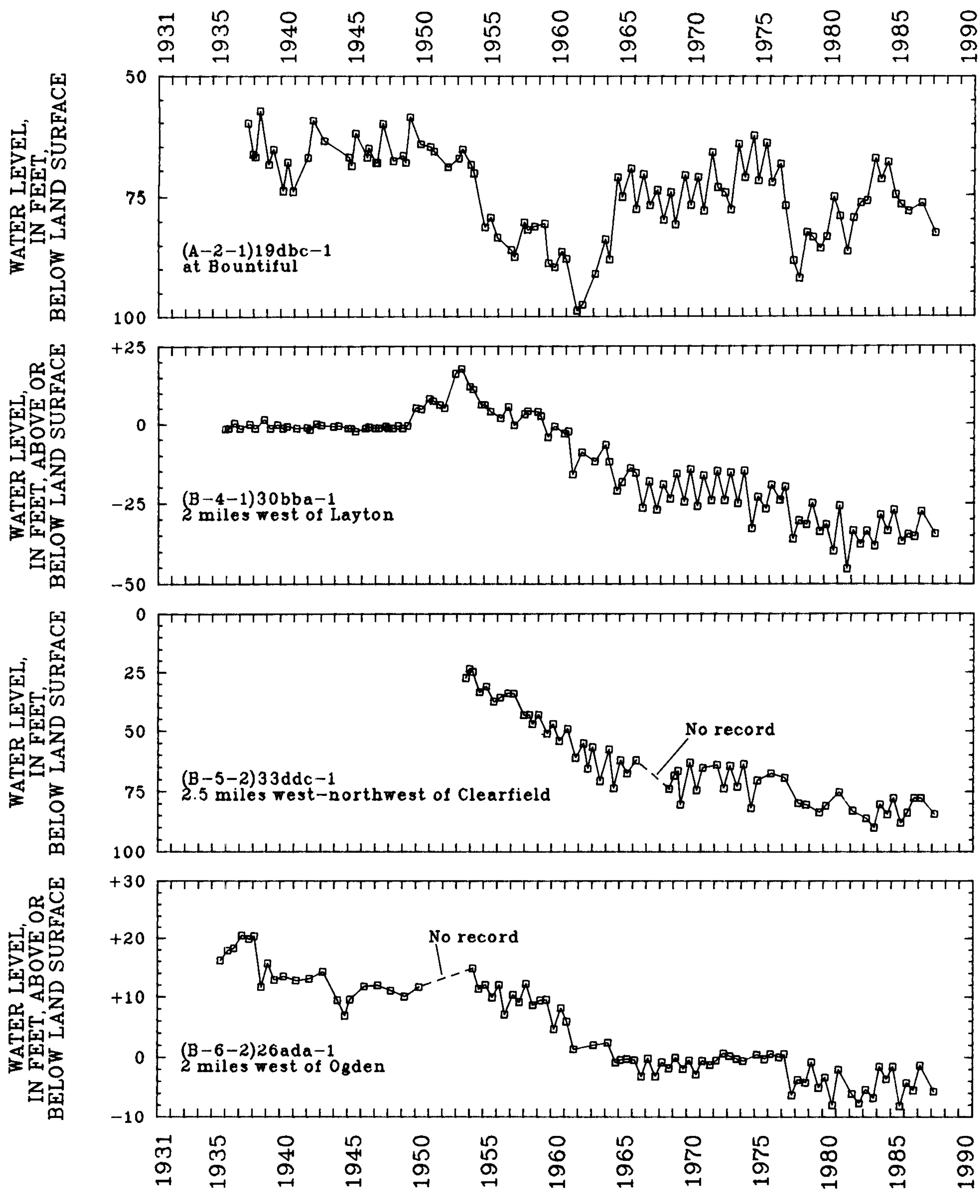

Figure 7.—Relation of water levels in selected wells in the East Shore area to cumulative departure from the average annual precipitation at Ogden Pioneer Powerhouse and to annual withdrawals from wells.

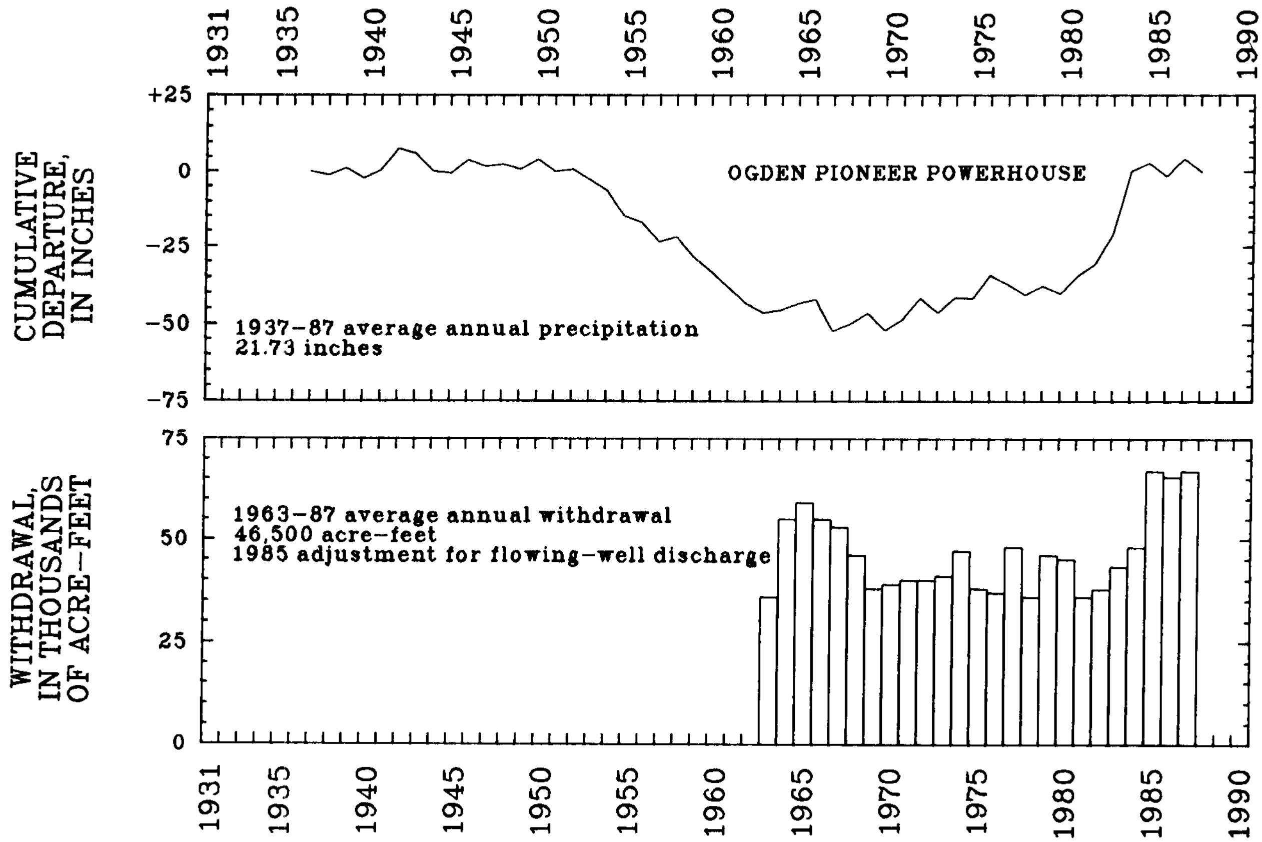

Figure 7.—Continued

SALT LAKE VALLEY

by G. J. Smith

Withdrawal of water from wells in Salt Lake Valley in 1987 was about 122,000 acre-feet, or about 18,000 acre-feet more than in 1986, and about 6,000 acre-feet more than the average annual withdrawal for 1977-86 (table 2). Withdrawal for public supply was 83,000 acre-feet and about 16,800 acre-feet more than the value for 1986. Withdrawal for industrial use was approximately 11,000 acre-feet, about the same as the amount reported for 1986.

From February 1987 to February 1988, water levels in the principal aquifer declined throughout the entire Salt Lake Valley, except for a small area near Kearns in the central part of the valley, which showed a slight rise (fig. 8). The area of largest water-level declines lies on the eastern edge of Salt Lake Valley, much of which coincides with the recharge area of the principal aquifer. The largest declines, nearly 14 feet, were measured in two wells just north of the center of Salt Lake City.

Water-level declines are the result of increased pumping and decreased recharge due to below-normal precipitation. Precipitation at Silver Lake near Brighton, Utah, was 35.25 inches, 7.76 inches below the average annual precipitation for 1931-87. At Salt Lake City WSO (International Airport), precipitation was 12.50 inches, 2.80 inches below the average annual value for 1931-87 (figs. 9 and 10).

The relation of water levels and chloride concentration in water from selected wells in the principal aquifer to precipitation, to total annual and public-supply withdrawals from wells, and to population is shown in figures 9 and 10. In August 1987, chloride concentrations in water from well (D-1-1)7abd-6 in Artesian Park in Salt Lake City, used by many persons for drinking water, reached the highest concentration ever measured, 120 milligrams per liter. Water levels in selected observation wells in the shallow unconfined aquifer in the northwestern part of the valley are shown in figure 11. Water levels in February 1988 were lower than for the same period in 1987.

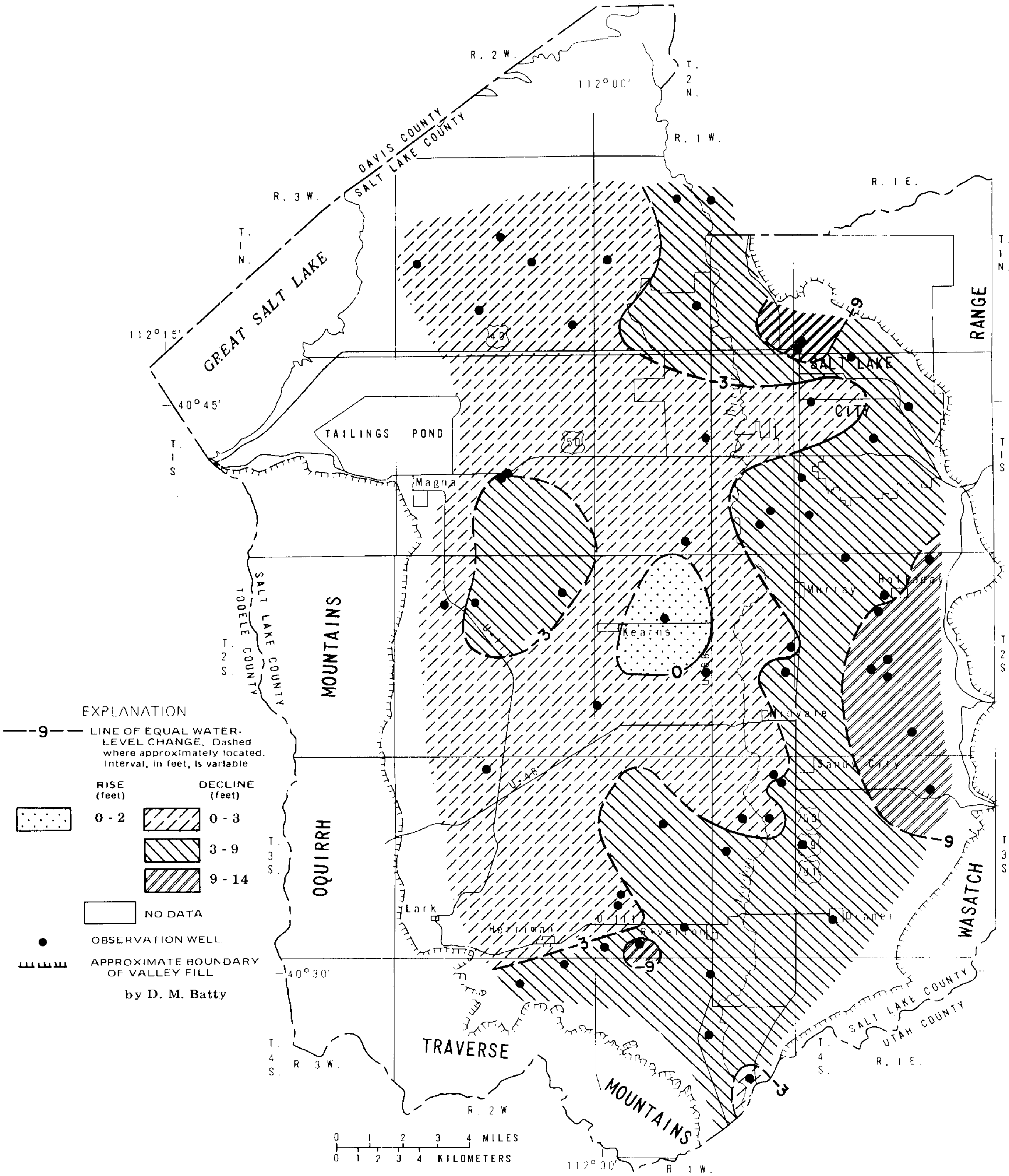

Figure 8.—Map of the Salt Lake Valley showing change of water levels in the principal aquifer from February 1987 to February 1988.

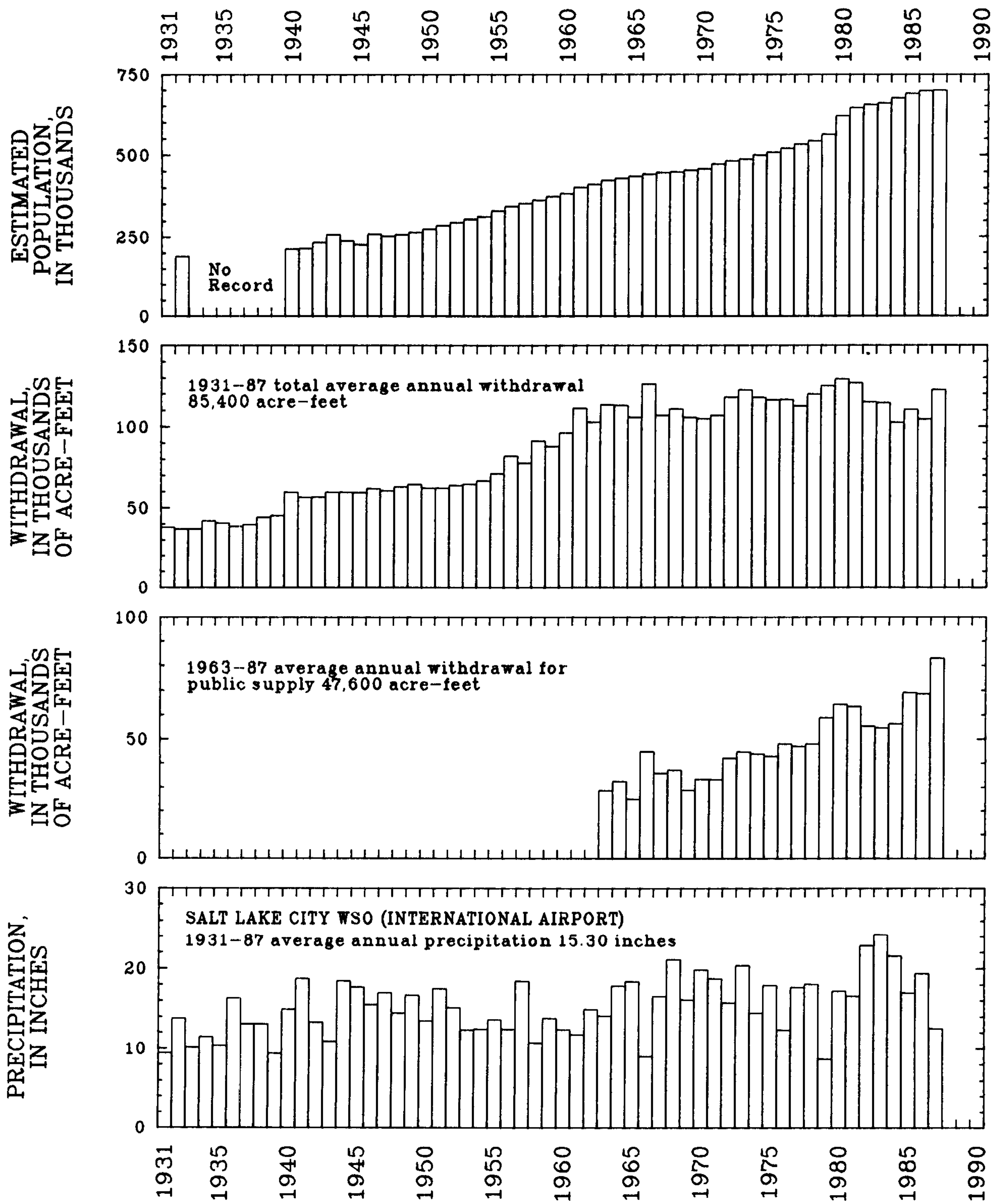

Figure 9.—Estimated population of Salt Lake County, total annual withdrawals from wells, annual withdrawal for public supply, and average annual precipitation at Salt Lake City WSO (International Airport).

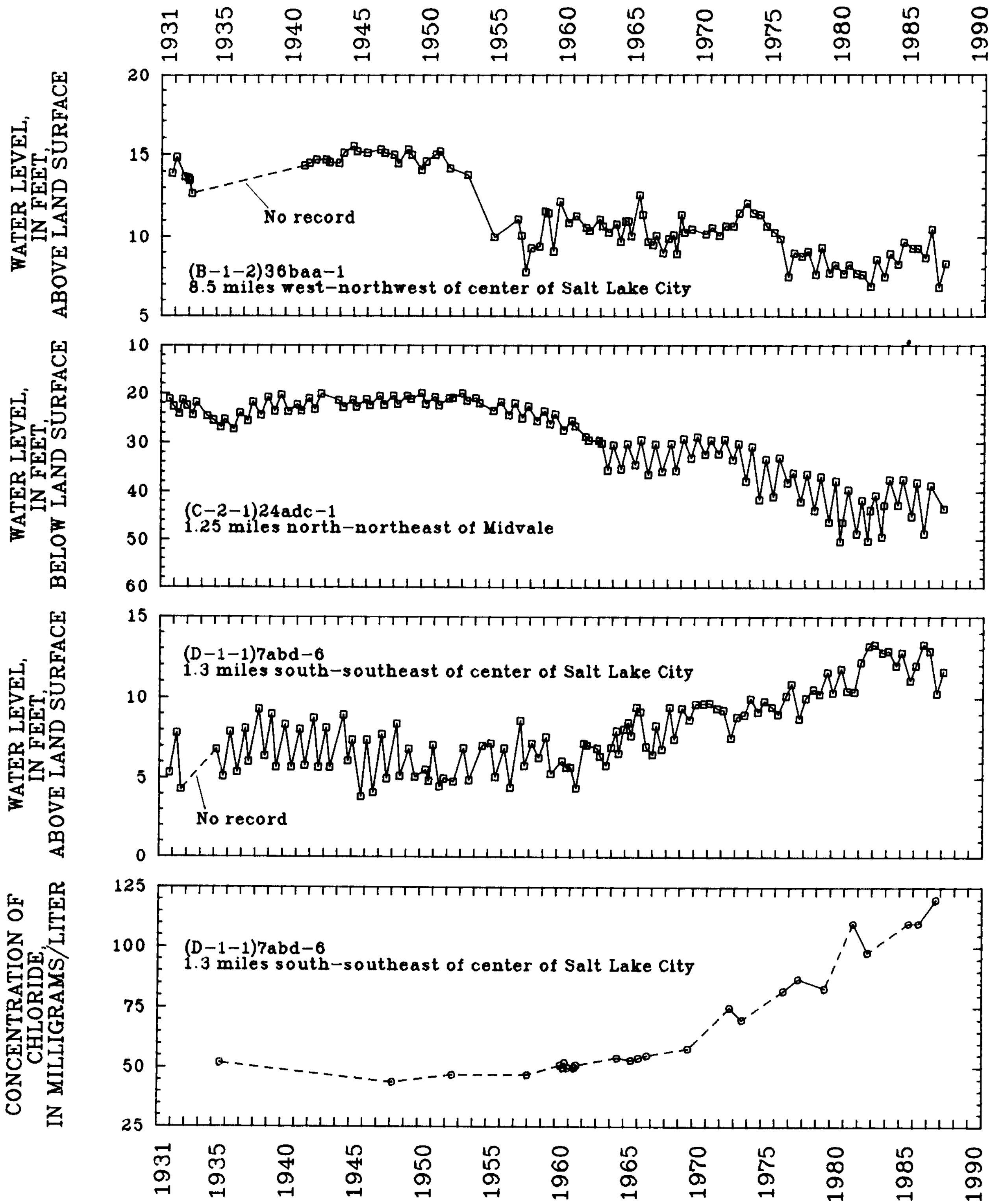

Figure 10.—Relation of water levels and chloride concentration in water from selected wells in the principal aquifer in Salt Lake Valley to cumulative departure from the average annual precipitation at Silver Lake Brighton.

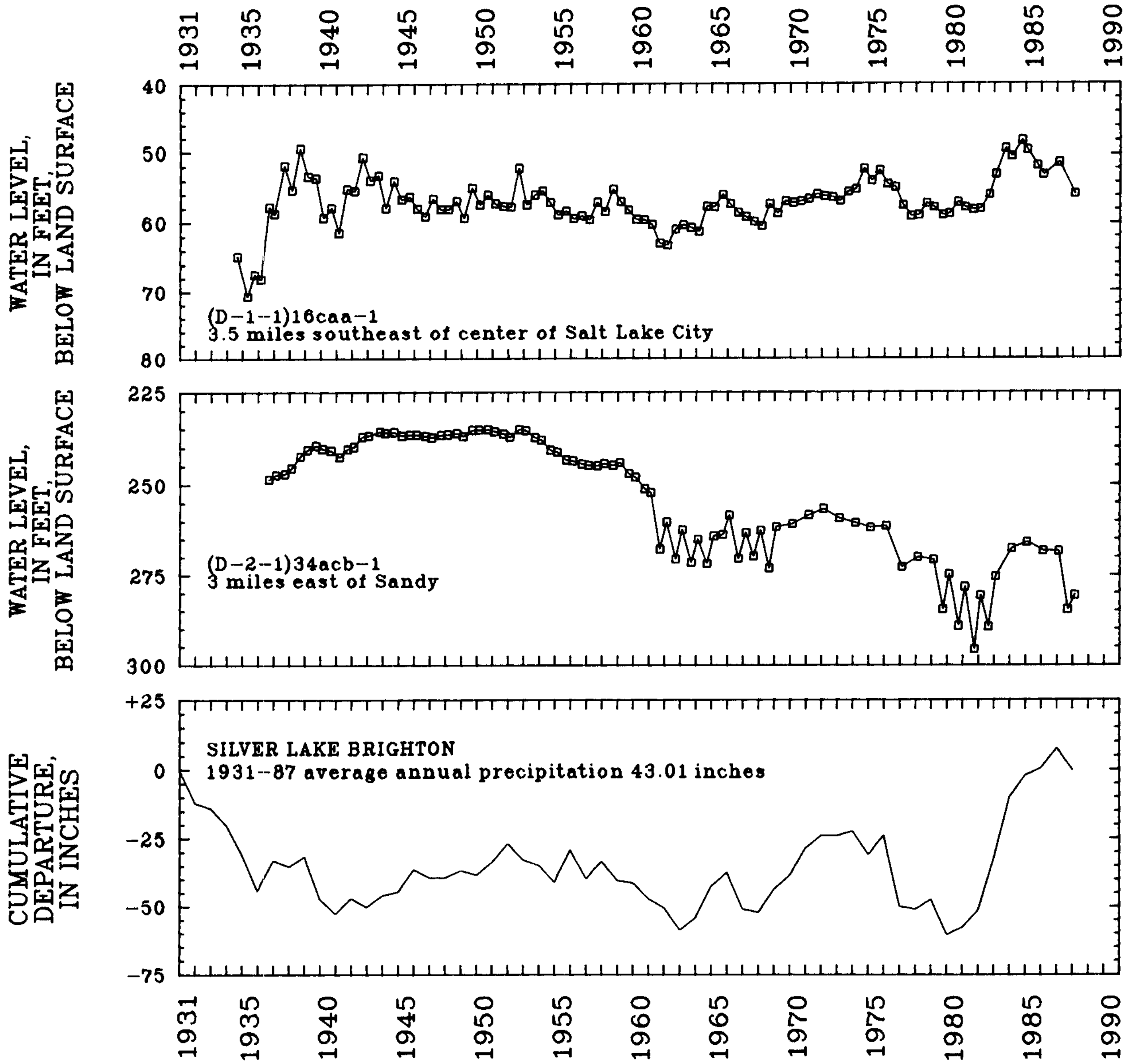

Figure 10.—Continued

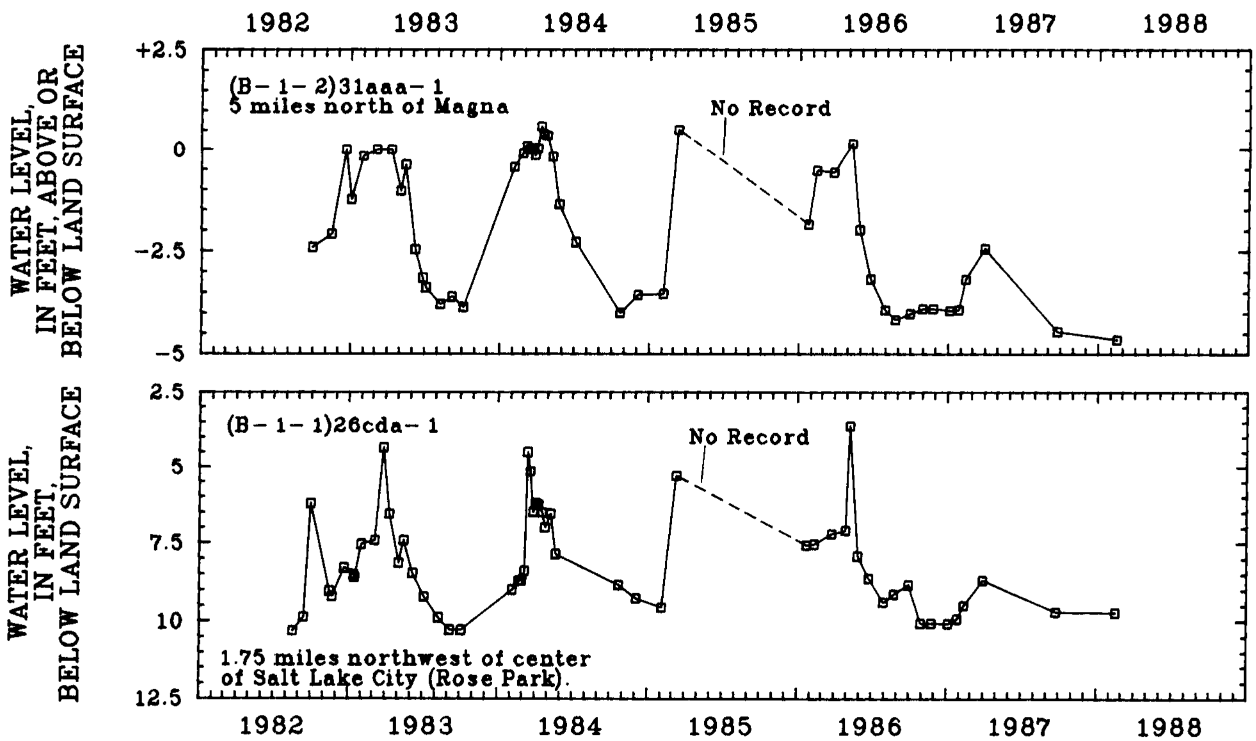

Figure 11.—Water levels in selected wells in the shallow unconfined aquifer in Salt Lake Valley.

TOOELE VALLEY

by John A. Yarbrough

In 1987, about 22,000 acre-feet of water was withdrawn from wells in Tooele Valley. This value is 1,000 acre-feet more than the revised ground-water withdrawal of 21,000 acre-feet for 1986, and 4,000 acre-feet less than the average annual withdrawal for 1977-86. A comparison of 1987 values with the revised withdrawal values for 1986 shows that withdrawals for public supply decreased by about 200 acre-feet, irrigation increased about 1,200 acre-feet, and industrial use decreased by about 250 acre-feet.

Water levels declined throughout most of Tooele Valley from March 1987 to March 1988, with the greatest declines occurring northeast of Tooele and in two wells in and near Grantsville (fig. 12). Water levels in the eastern part of the valley, which includes Tooele Army Depot (TAD), Tooele, and Lakepoint, declined as much as 5 feet. Water levels in much of the central and western parts of the valley declined as much as 2 feet. Three isolated areas of the valley showed increases of 0-2 feet, one located about 3 to 4 miles north of Grantsville, the second about 2 miles northwest of Erda, and the third about one-half mile east of Grantsville.

The relation of water levels in selected observation wells to precipitation at Tooele and to annual withdrawals from wells is shown in figure 13. Precipitation at Tooele in 1987 was 18.58 inches; although this was a decrease of 6.89 inches from 1986, annual precipitation in 1987 still exceeded the long-term average annual precipitation for the sixth consecutive year (fig. 13). The declines in water levels in most of Tooele Valley probably resulted from the decrease in precipitation in 1987 as compared to 1986 and the increase in ground-water withdrawals.

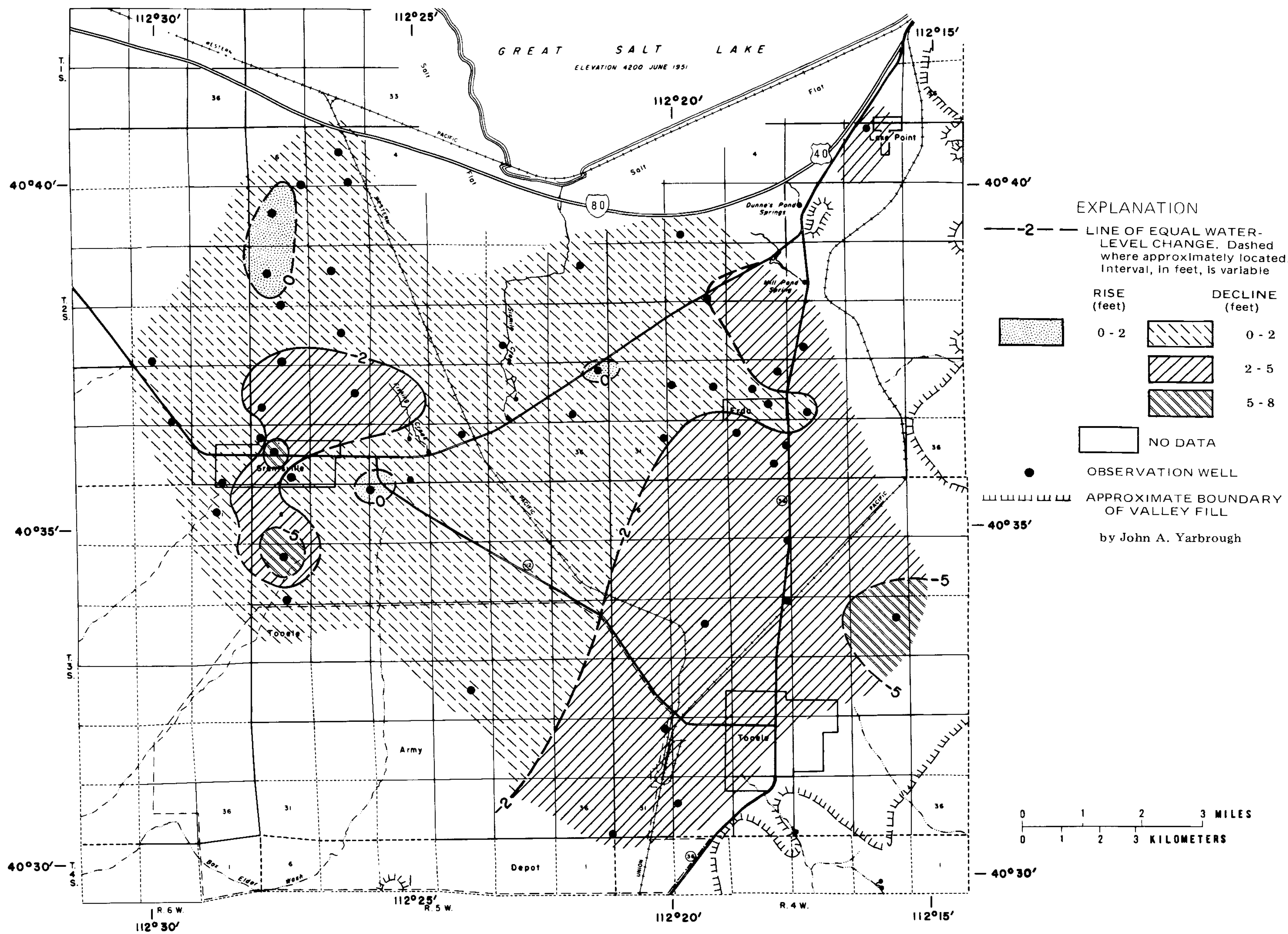

Figure 12.—Map of Tooele Valley showing change of water levels in artesian aquifers from March 1987 to March 1988.

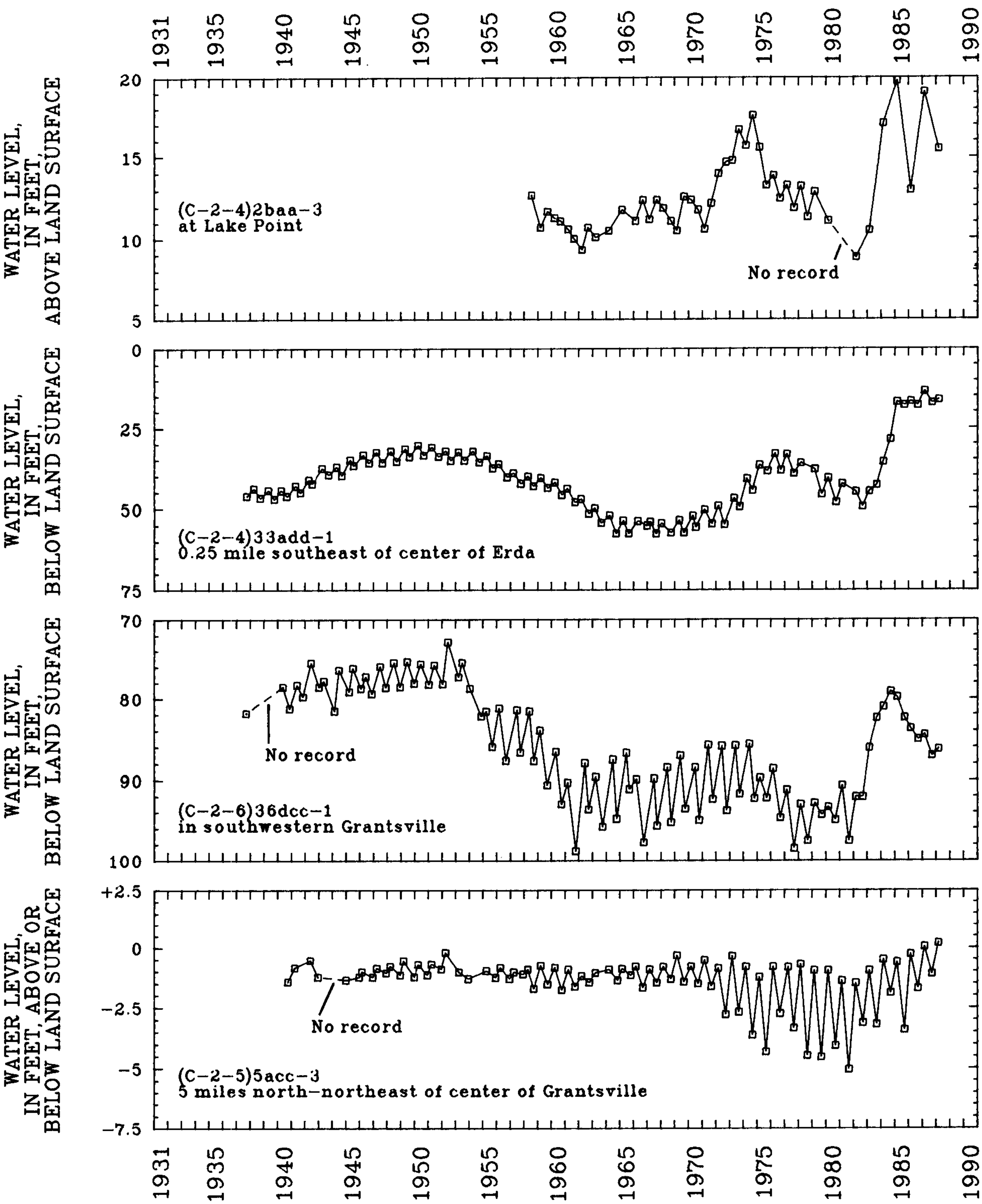

Figure 13.—Relation of water levels in selected wells in Tooele Valley to cumulative departure from the average annual precipitation at Tooele and to annual withdrawals from wells.

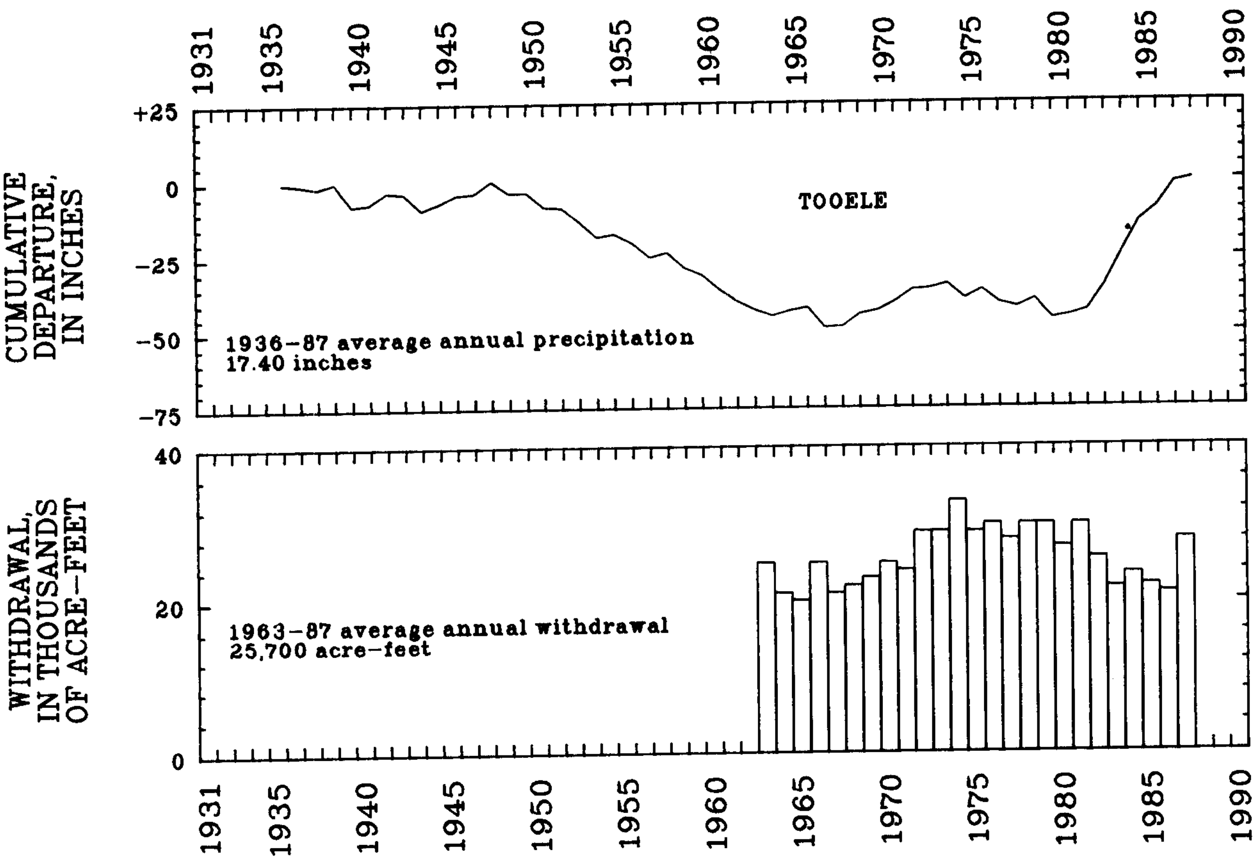

Figure 13.—Continued

Utah and Goshen Valleys

by Carole Burden

Withdrawal of water from wells in Utah and Goshen Valleys in 1987 was about 104,000 acre-feet. This was 29,000 acre-feet more than in 1986 and 11,000 acre-feet more than the average annual withdrawal for 1977-86 (table 2). Withdrawal in Utah Valley was about 96,300 acre-feet, or 31,900 acre-feet more than in 1986. Withdrawal in Goshen Valley was about 7,100 acre-feet, or 3,200 acre-feet less than in 1986. The increase in Utah Valley was mainly due to increased withdrawals for municipal and industrial use. The decrease in Goshen Valley was mainly due to decreased withdrawals for irrigation.

From March 1987 to March 1988, water levels rose in the western part of Goshen Valley and declined in the eastern part (fig. 14). The rises were due mainly to decreased withdrawals for irrigation and slightly above-average precipitation. The declines probably were due to continued large local withdrawals. Water levels declined in all aquifers in Utah Valley from March 1987 to March 1988 except in the water-table aquifer between Alpine and Pleasant Grove, where water levels rose slightly (figs. 14-17). The declines in Utah Valley were due mainly to increased withdrawals for irrigation and municipal and industrial use. The rises may be due to local decreases in withdrawals.

The relation of water levels in selected observation wells to precipitation, total annual withdrawals from wells, annual withdrawals for public supply, and estimated population of Utah County is shown in figure 18.

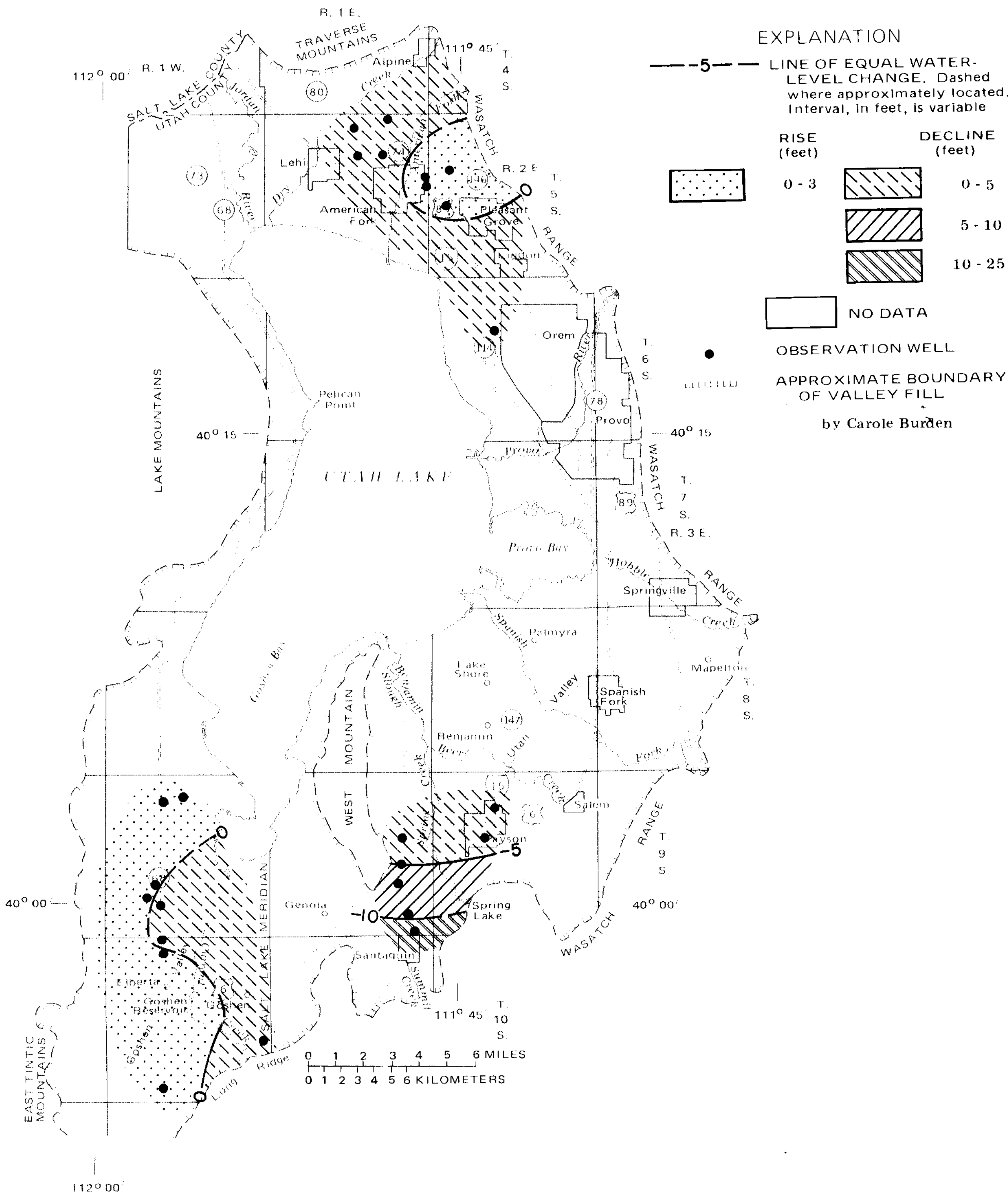

Figure 14.--Map of Utah and Goshen Valleys showing change of water levels in the watei table aquifers from March 1987 to March 1988.

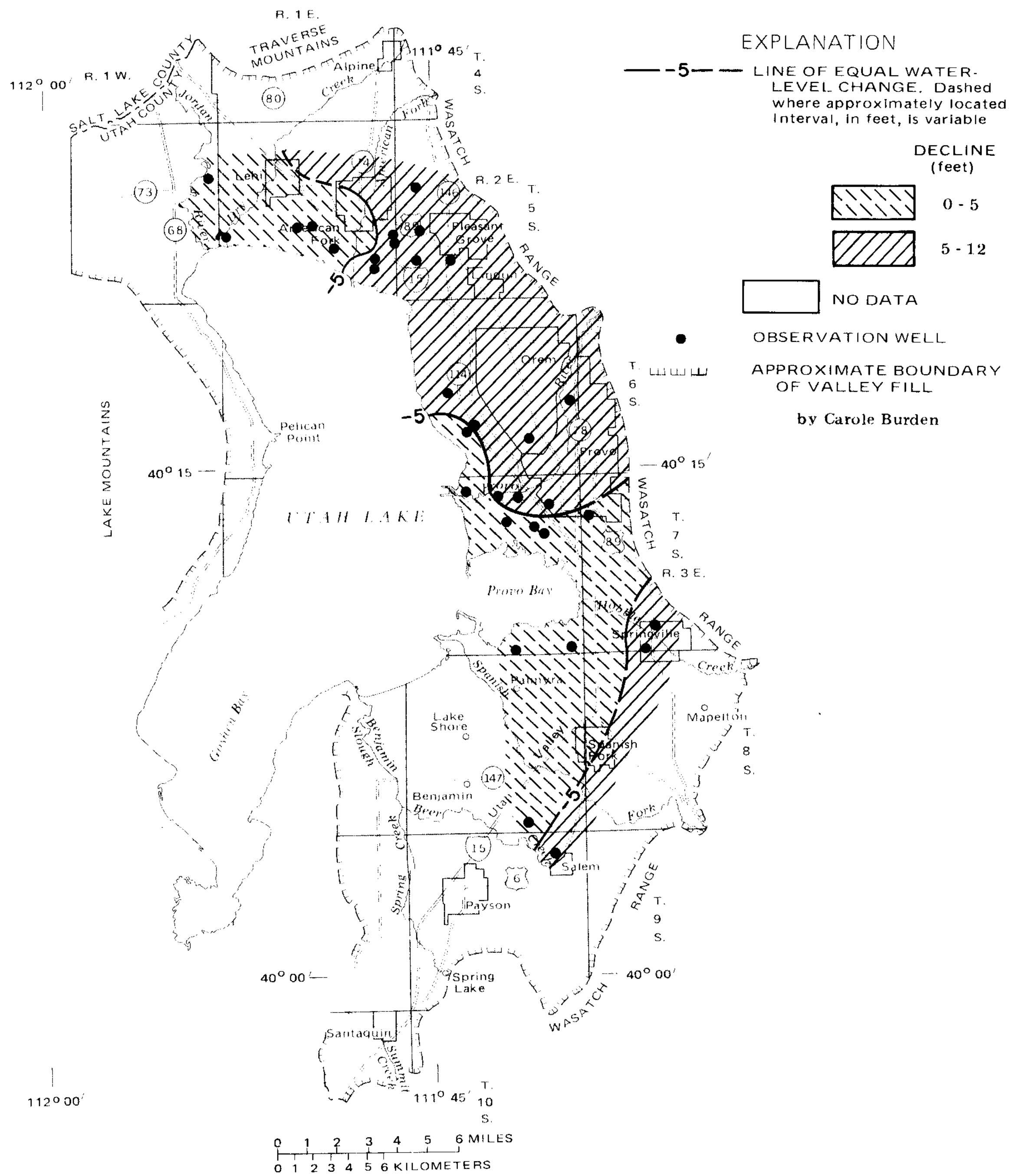

Figure 15.—Map of Utah Valley showing change of water levels in the shallow artesian aquifer in deposits of Pleistocene age from March 1987 to March 1988.

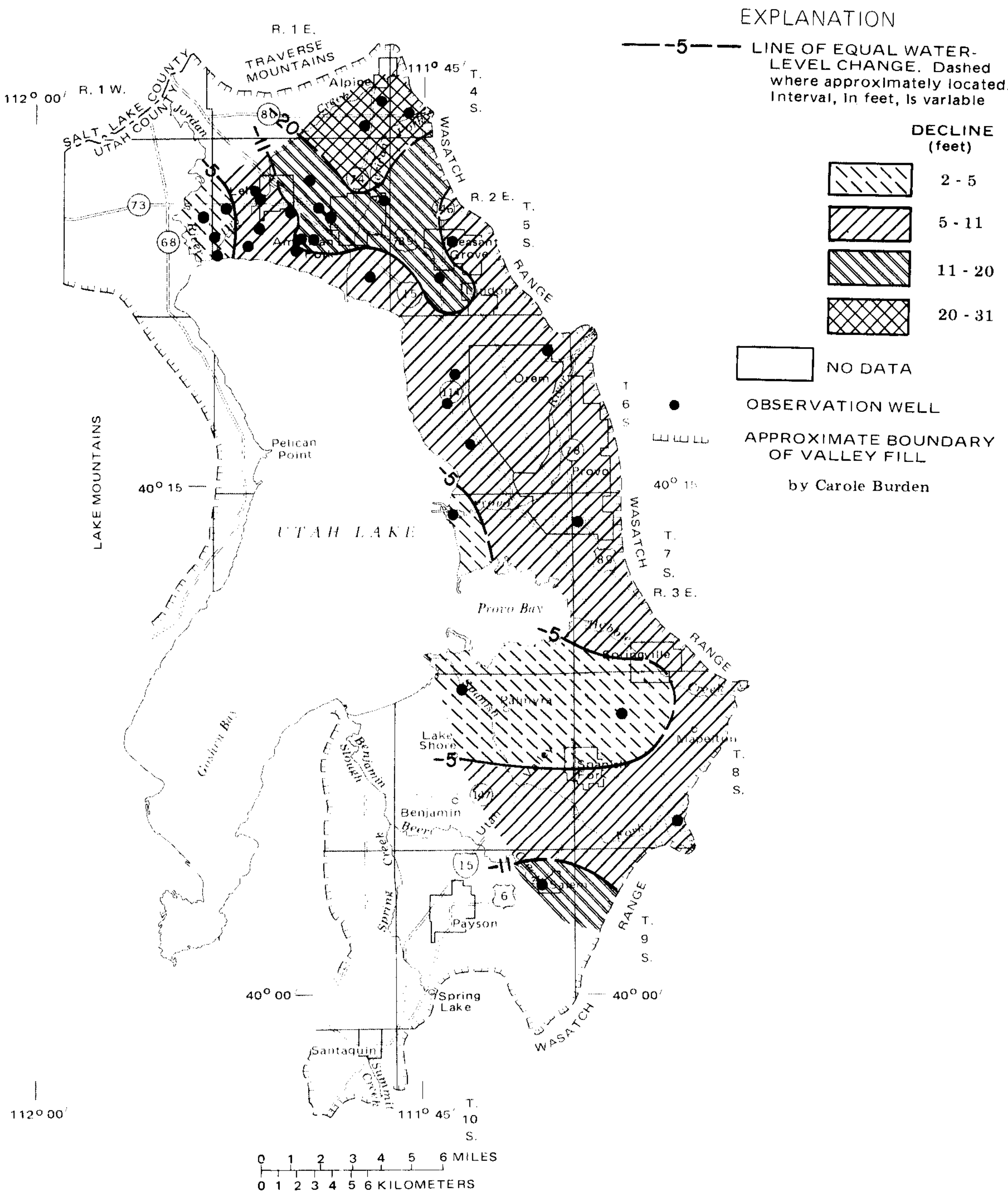

Figure 16.—Map of Utah Valley showing change of water levels in the deep artesian aquifer in deposits of Pleistocene age from March 1987 to March 1988.

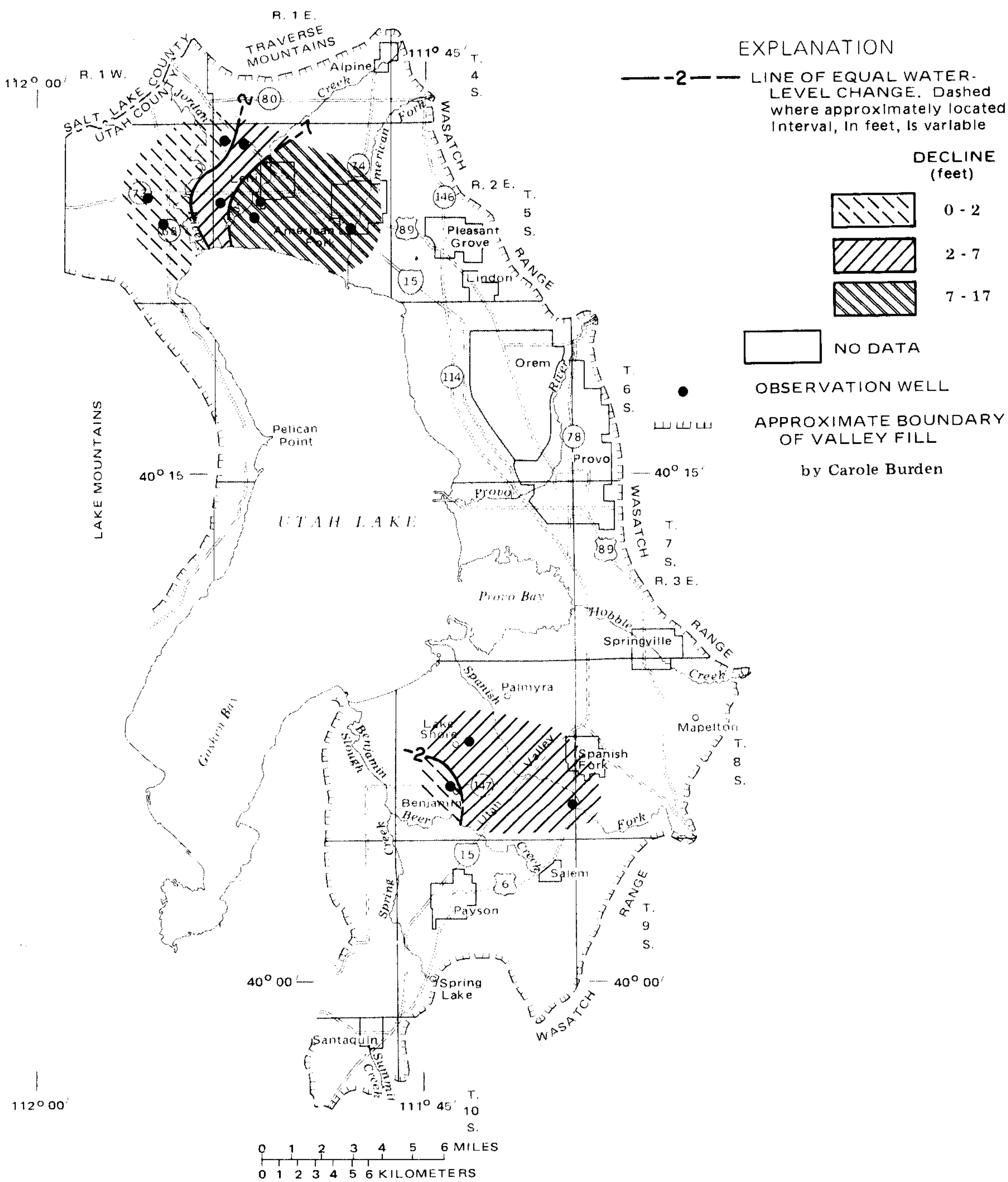

Figure 17.—Map of Utah Valley showing change of water levels in the artesian aquifer in deposits of Quaternary or Tertiary age from March 1987 to March 1988.

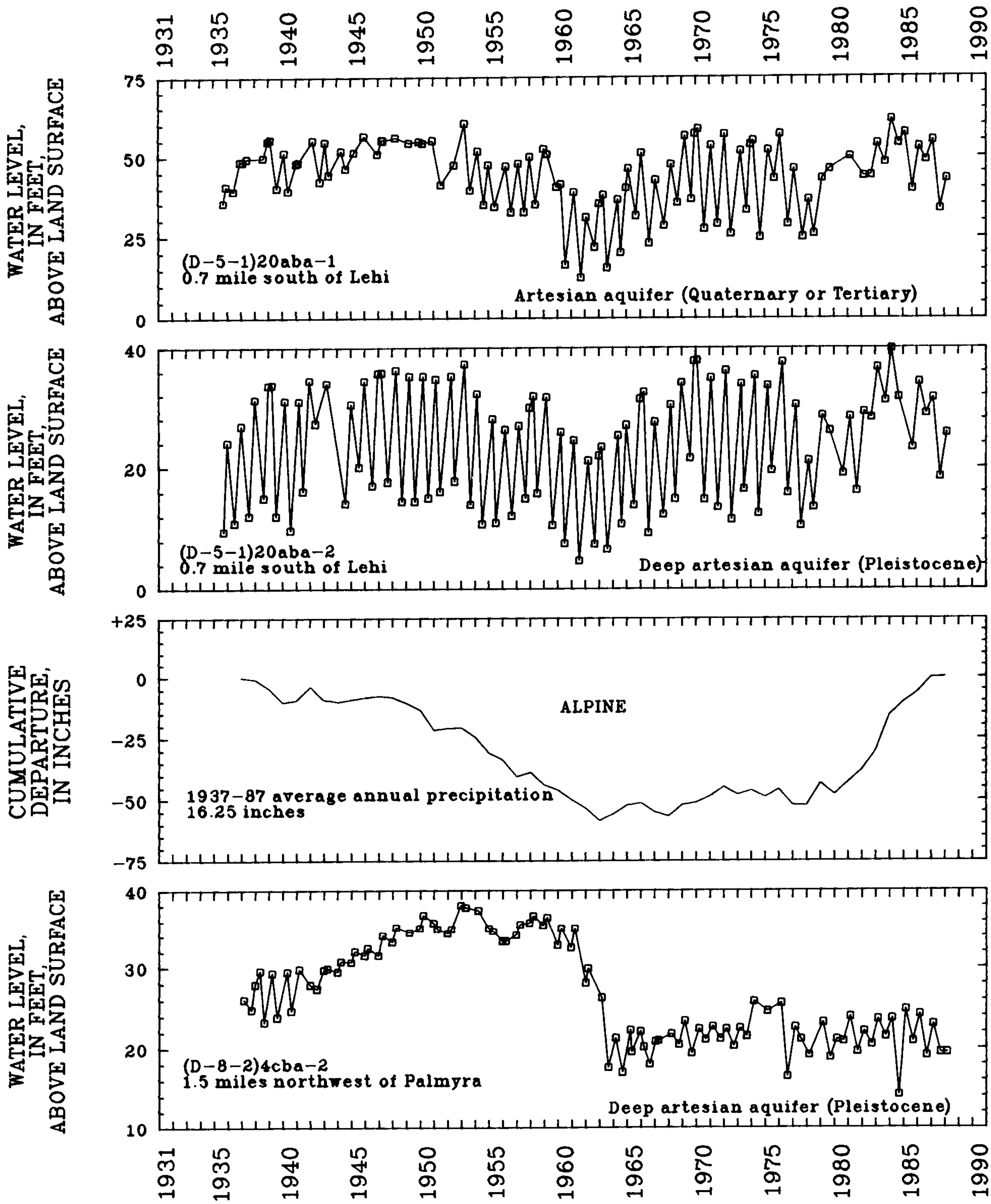

Figure 18.—Relation of water levels in selected wells to cumulative departure from the average annual precipitation at Alpine and Spanish Fork Powerhouse, to total annual withdrawals from wells and annual withdrawals for public supply in Utah and Goshen Valleys, and to estimated population of Utah County.

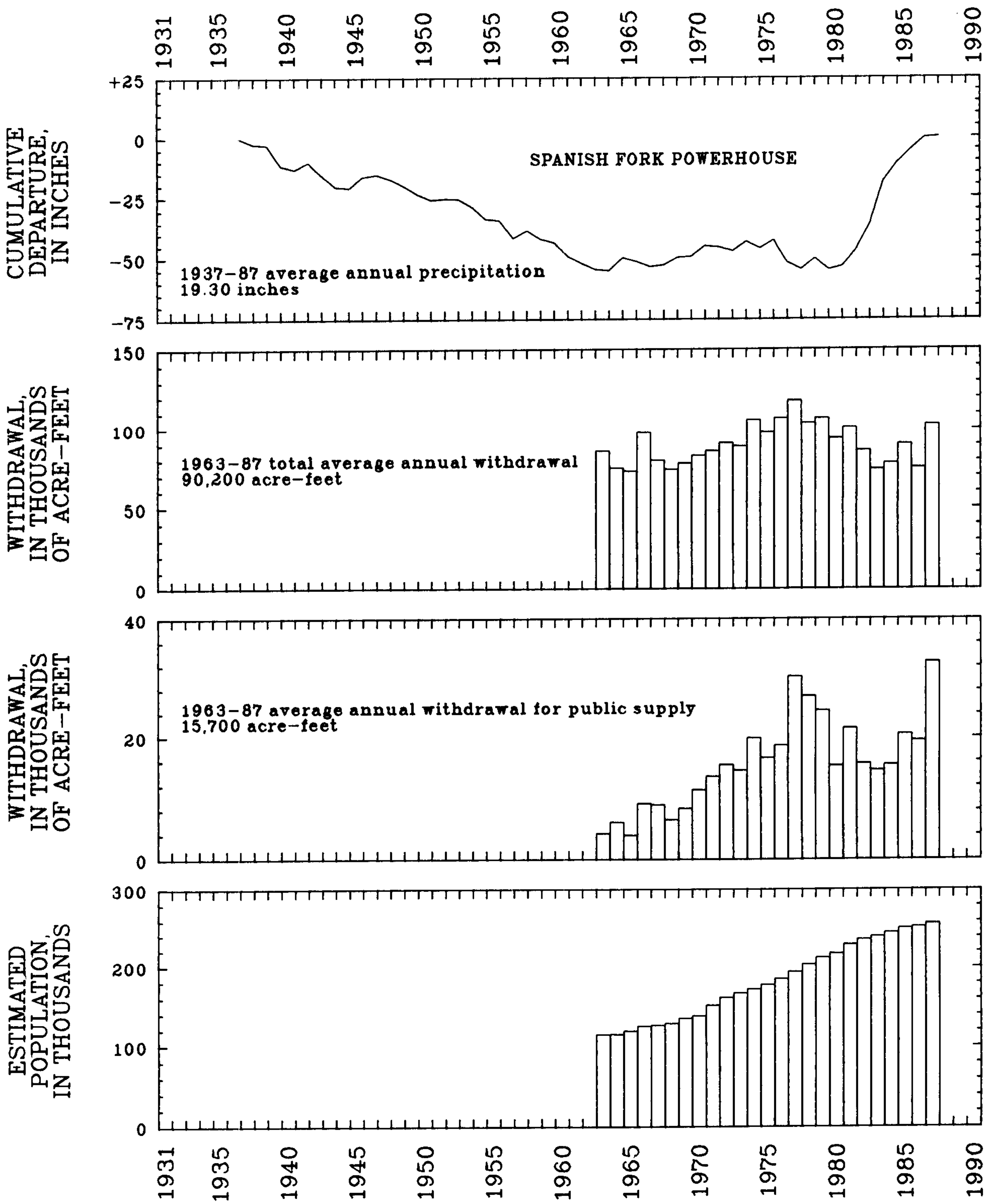

Figure 18.—Continued

JUAB VALLEY

by R. B. Garrett

Withdrawal of water from wells in Juab Valley during 1987 was about 22,000 acre-feet. This is 12,000 acre-feet more than reported for 1986 and 7,000 acre-feet more than the average annual withdrawal for 1977-86 (table 2). The increase in total withdrawal was due to a large increase in withdrawals for irrigation, probably resulting from lower precipitation in 1987 than in 1986 with an accompanying smaller supply of surface water for irrigation.

Water levels rose as much as 3 feet in an east-west section of the valley along Levan Ridge and to the north and south of Levan Ridge along the west side of the valley. Water levels declined in all other areas of the valley, including declines of nearly 13 feet near Nephi to almost 23 feet near Levan (fig. 19). The declines are related to the large increase in ground-water withdrawals.

The relation of water levels in two observation wells to annual withdrawals from wells and to cumulative departure from the average annual precipitation for 1935-87 at Nephi is shown in figure 20. Precipitation at Nephi during 1987 was 14.26 inches, 0.08 inches below the average annual precipitation for 1935-87.

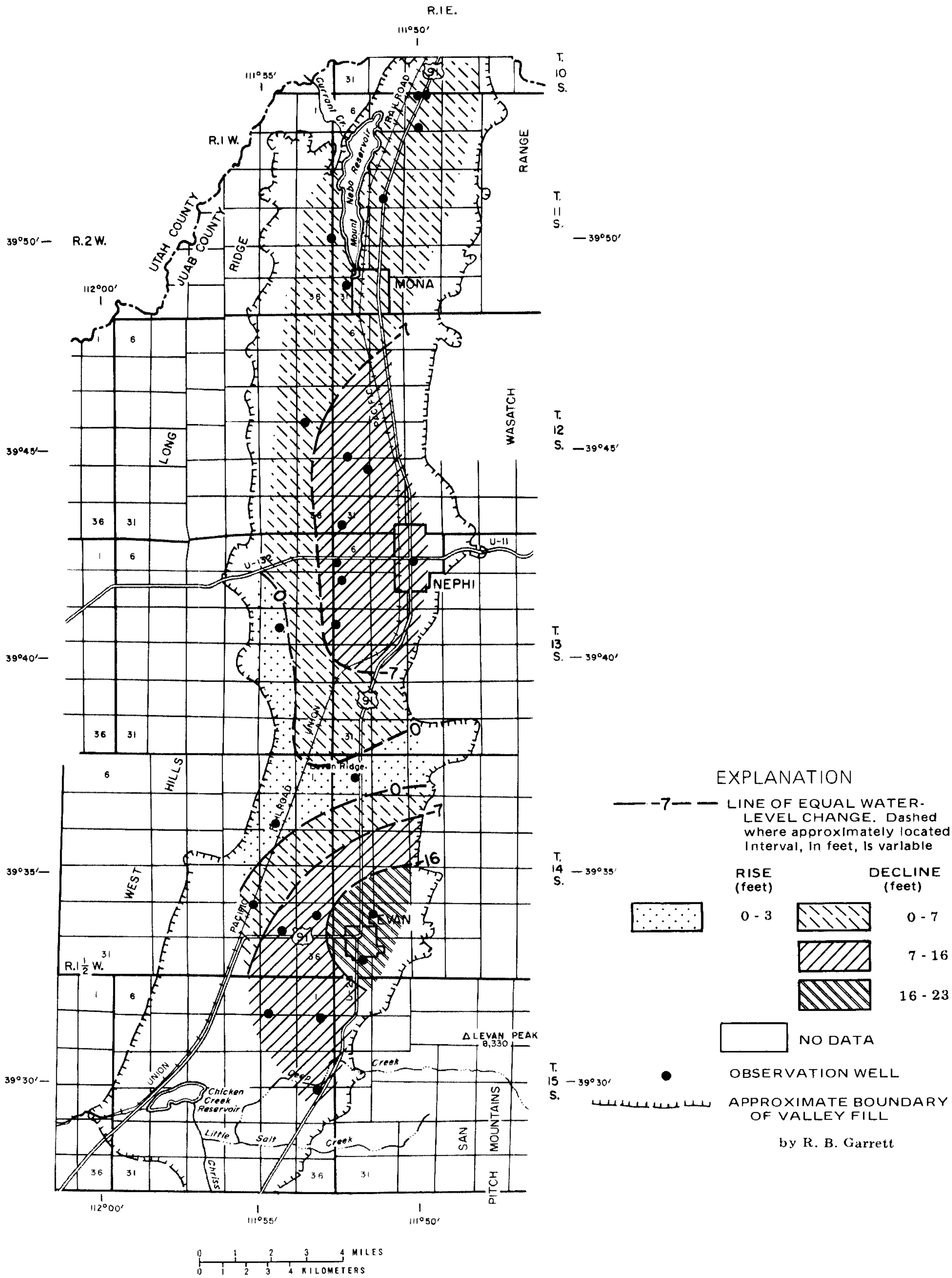

Figure 19.—Map of Juab Valley showing change of water levels from March 1987 to March 1988.

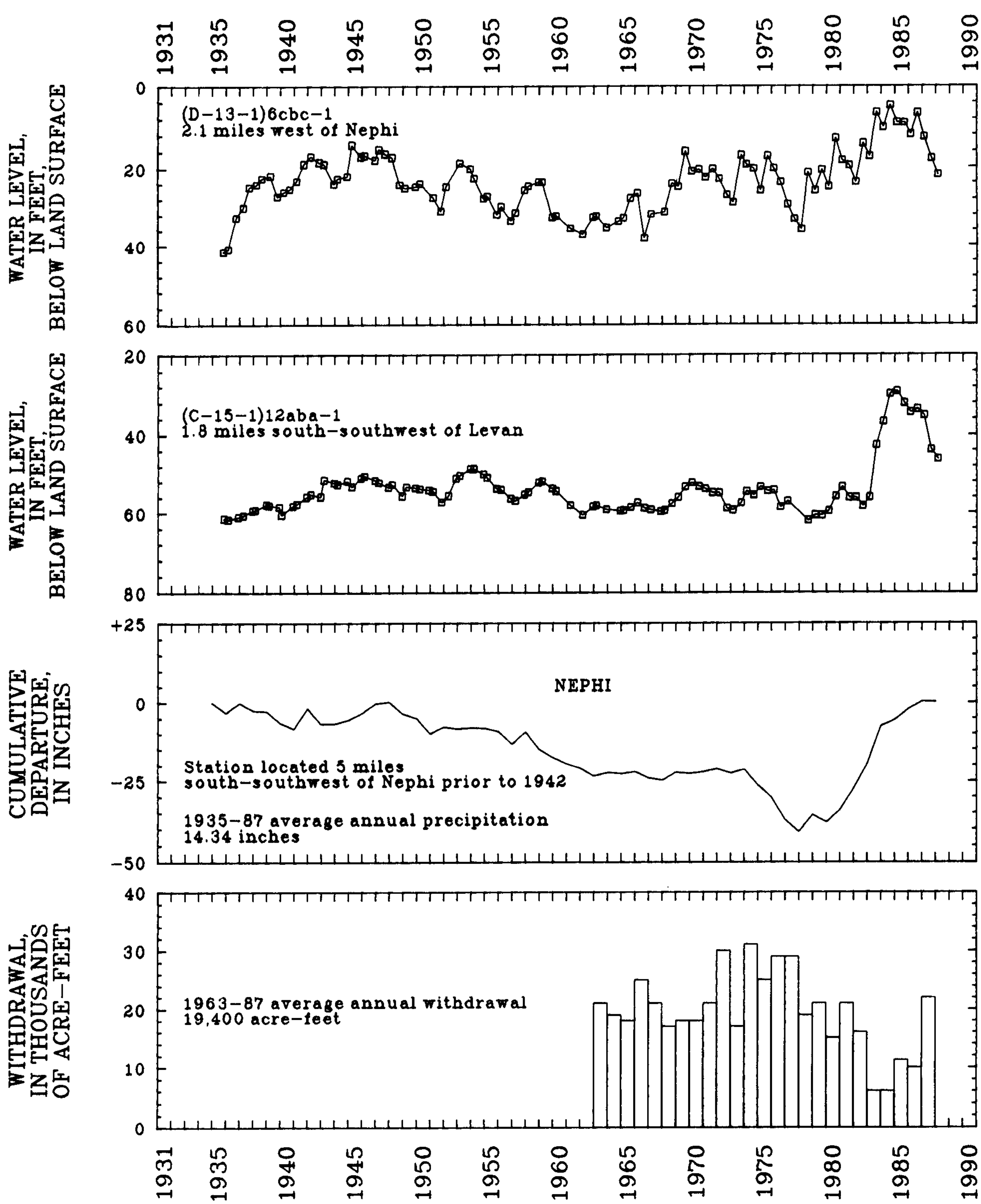

Figure 20.—Relation of water levels in selected wells in Juab Valley to cumulative departure from the average annual precipitation at Nephi and to annual withdrawals from wells.

Sevier Desert

by R. B. Garrett

Withdrawal of water from wells in the Sevier Desert in 1987 was about 15,000 acre-feet. This was 4,000 acre-feet more than was reported for 1986 and about 7,000 acre-feet less than the 1977-86 average annual withdrawal (table 2).

Water levels in the shallow artesian aquifer both rose and declined in areas of about the same size from March 1987 to March 1988 (fig. 21). The largest rise was about 15 feet in a well near the Desert Mountains. The largest decline was about 8 feet in a well 1.5 miles north of Oak City.

Water levels in the deep artesian aquifer generally declined (fig. 22). The largest rise was 1.3 feet in a well 6 miles north of Delta. The largest decline was about 8 feet in a well about 1.5 miles north of Oak City.

Declines in both aquifers may be the result of increased withdrawals for irrigation in 1987 compared to 1986. Increased withdrawals were prompted by a decrease in the availability of surface water for irrigation as indicated by the discharge of the Sevier River near Juab (fig. 23). During 1987, the discharge was 280,500 acre-feet, 134,400 acre-feet less than the 1986 value. However, the 1987 discharge exceeded the 1935-87 average annual discharge by 92,500 acre-feet.

Precipitation for 1987 at Oak City was 12.61 inches, which is 0.27 inches below the 1935-87 average annual precipitation. This near-average precipitation and continued below-average ground-water withdrawals have combined to keep ground-water levels fairly constant, as over 80 percent of the observation wells had water-level changes of less than 1 foot from March 1987 to March 1988.

The relation of water levels in selected wells to discharge of the Sevier River near Juab, to precipitation at Oak City, and to annual withdrawals from wells is shown in figure 23.

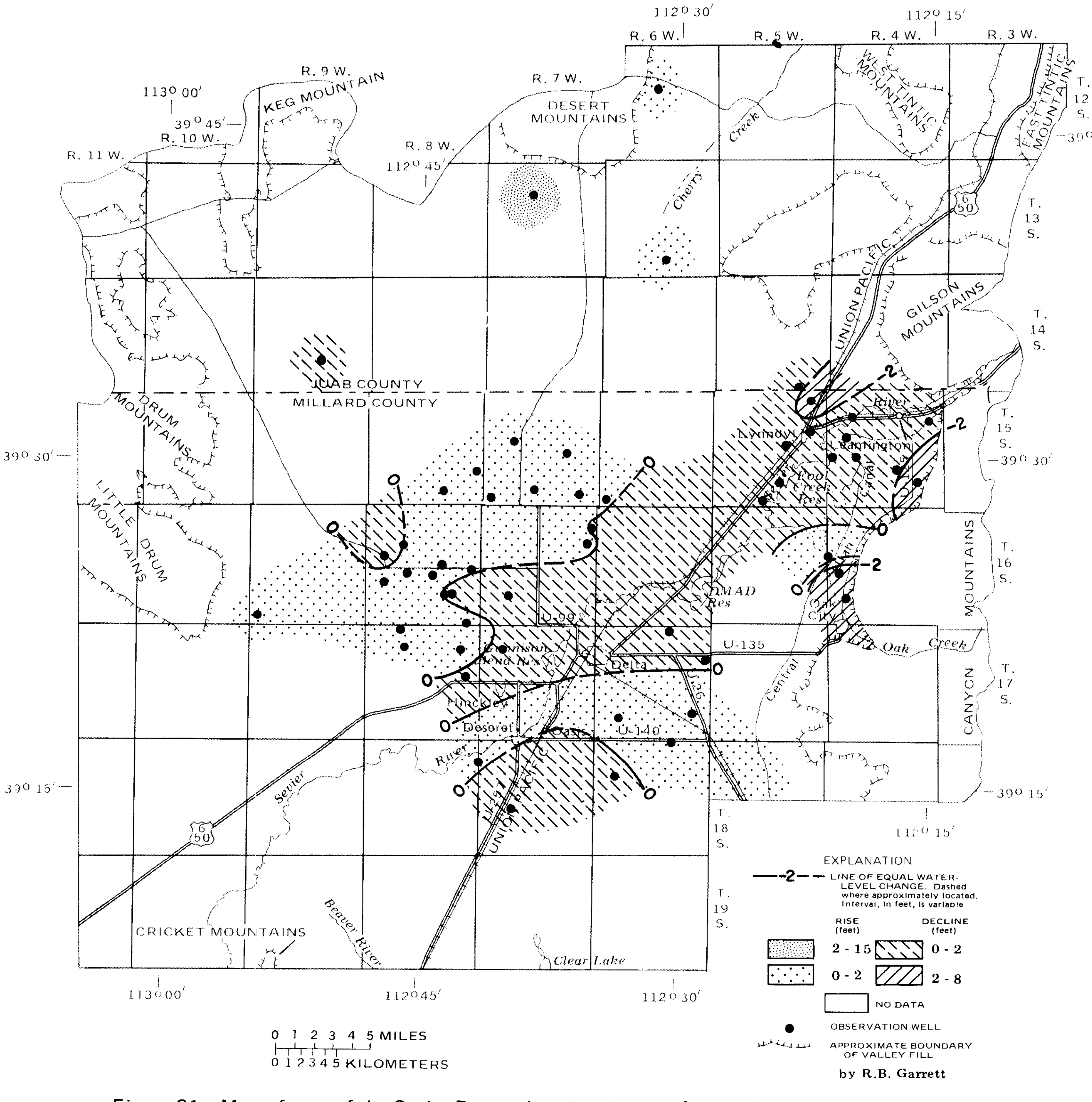

Figure 21.– Map of part of the Sevier Desert showing change of water levels in the shallow artesian aquifer from March 1987 to March 1988.

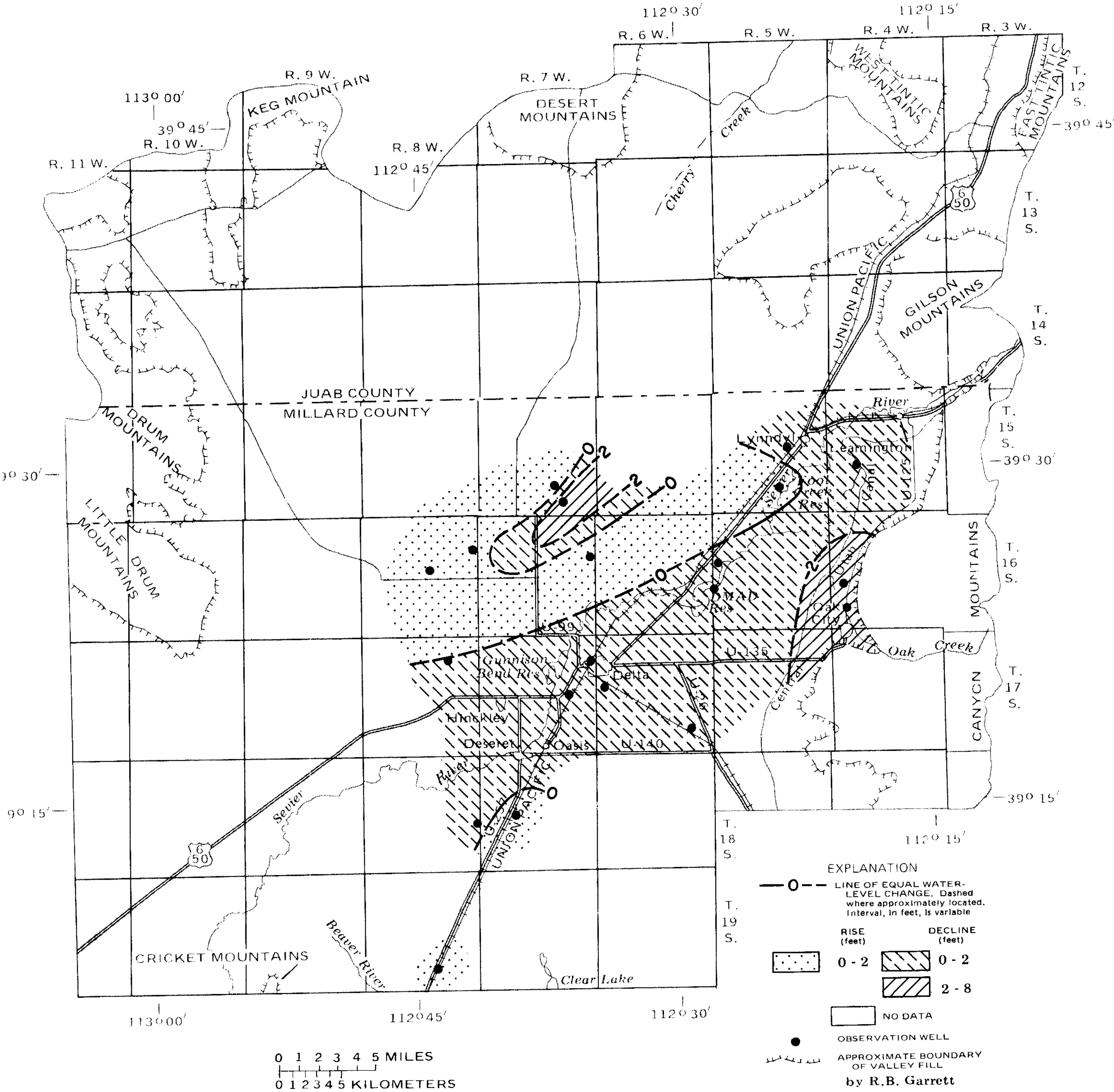

Figure 22.—Map of part of the Sevier Desert showing change of water levels in the deep artesian aquifer from March 1987 to March 1988.

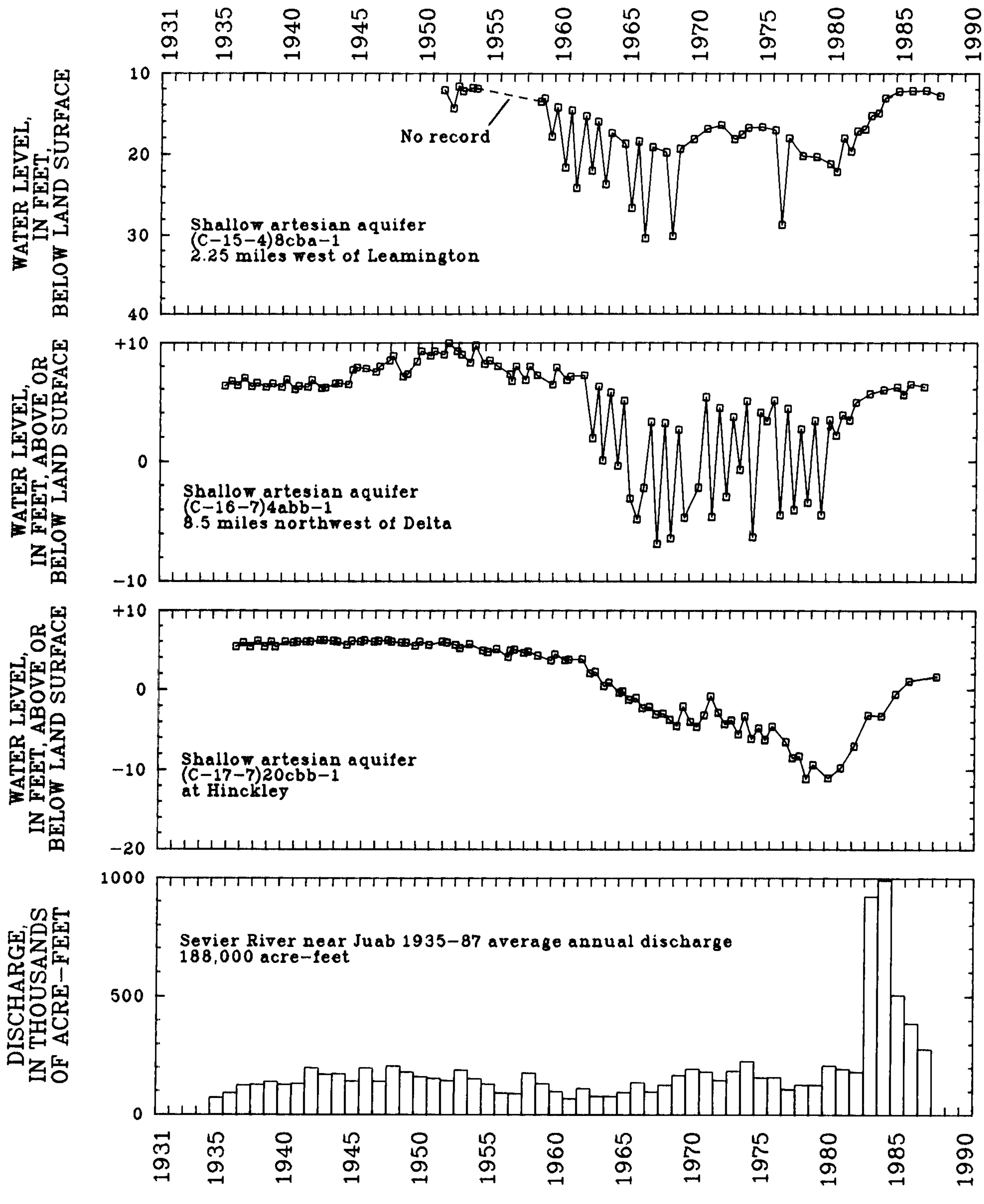

Figure 23.—Relation of water levels in selected wells in the Sevier Desert to discharge of the Sevier River near Juab, to cumulative departure from the average annual precipitation at Oak City, and to annual withdrawals from wells.

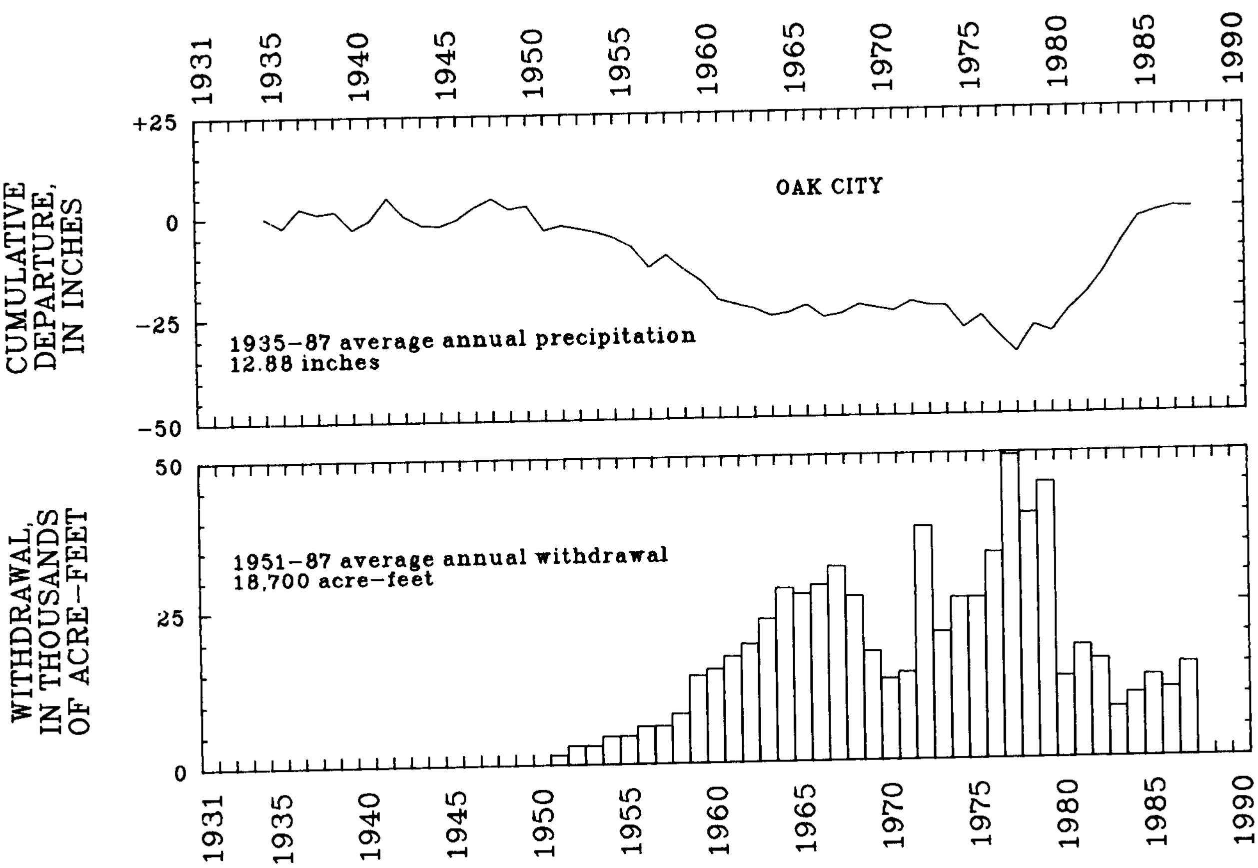

Figure 23.—Continued

UPPER AND CENTRAL SEVIER VALLEYS AND UPPER FREMONT RIVER VALLEY

By D. C. Emett

Withdrawal of water from wells in the upper and central Sevier Valleys and upper Fremont River valley in 1987 was about 22,000 acre-feet, the same as in 1986 and about 2,000 acre-feet less than the average annual withdrawal for 1977-86 (table 2). Withdrawals from wells for irrigation decreased slightly in 1987.

Water levels rose in 4 wells and declined in 33 wells (fig. 24). The largest observed water-level rise was 2.5 feet in a well near Otter Creek Reservoir. The largest observed water-level decline was 5.4 feet in a well northeast of Richfield which operated throughout the winter on a regular basis for watering stock.

The relation of water levels in selected wells to discharge of the Sevier River at Hatch, to precipitation at Panguitch, Salina, and Loa, and to annual withdrawal from wells is shown in figure 25. Precipitation was above average at Loa and below average at Salina and Panguitch. The discharge of the Sevier River at Hatch in 1987 was about 71,400 acre-feet, 9,100 acre-feet lower than the 1940-87 average annual discharge of 80,500 and the lowest annual discharge since 1981. The general decline in water levels from March 1986 to March 1987 probably is related to the smaller streamflow in 1987 as compared to 1986 and earlier years.

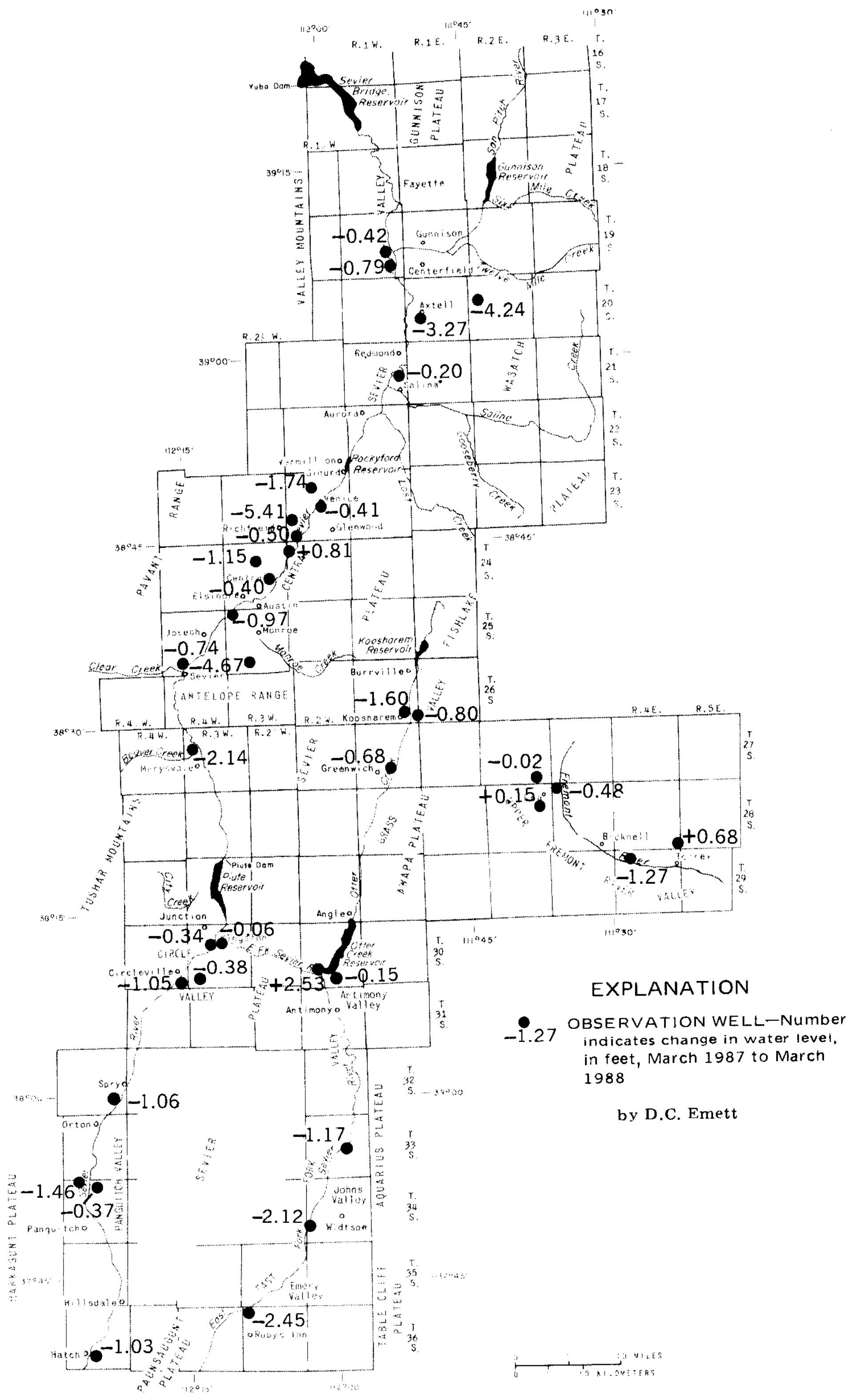

Figure 24.—Map of the upper and central Sevier Valleys and the upper Fremont River valley showing change of water levels from March 1987 to March 1988.

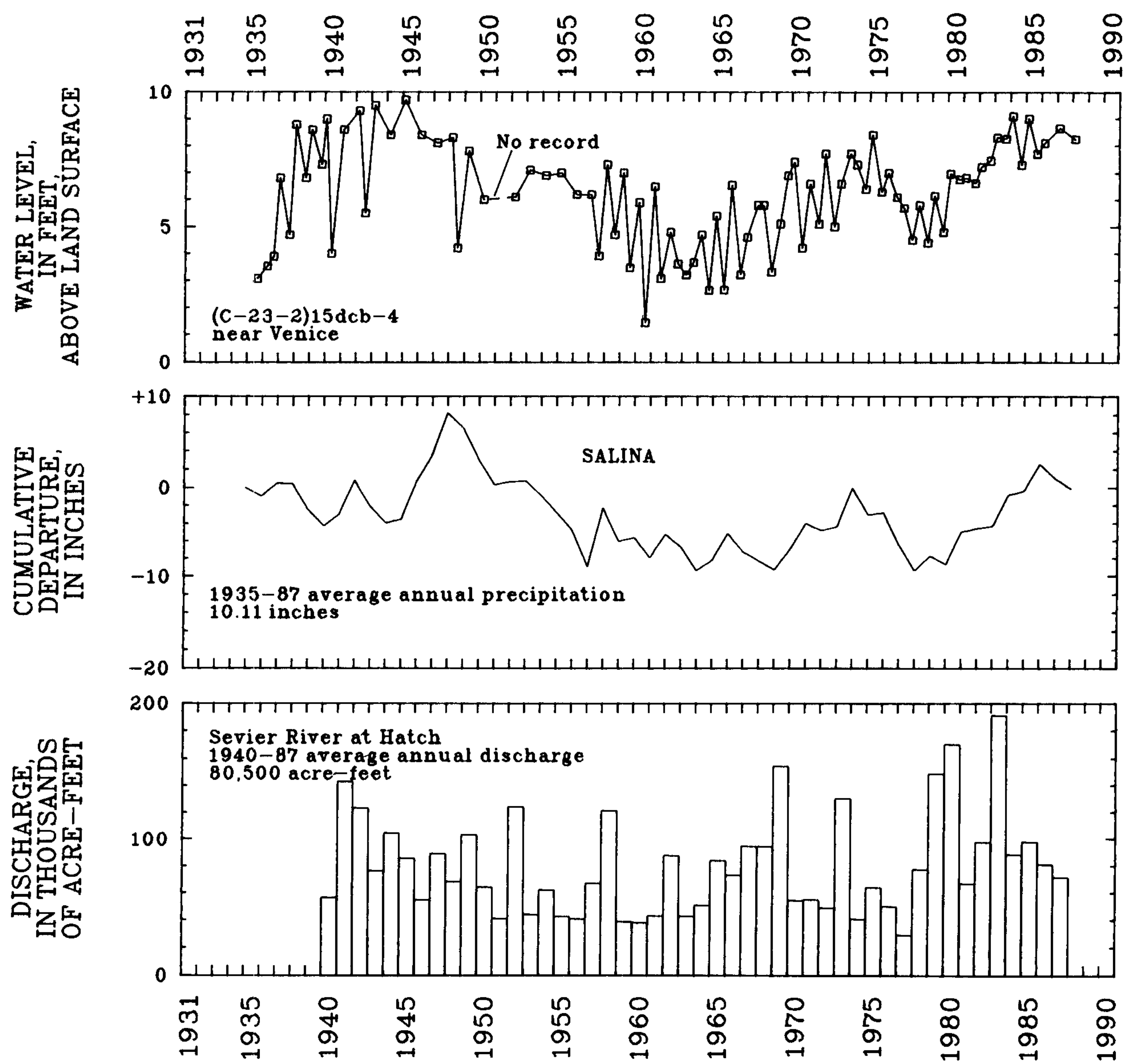

Figure 25.—Relation of water levels in selected wells to discharge of the Sevier River at Hatch, to cumulative departure from average annual precipitation at selected climate stations, and to annual withdrawal from wells—upper and central Sevier Valleys and upper Fremont River valley.

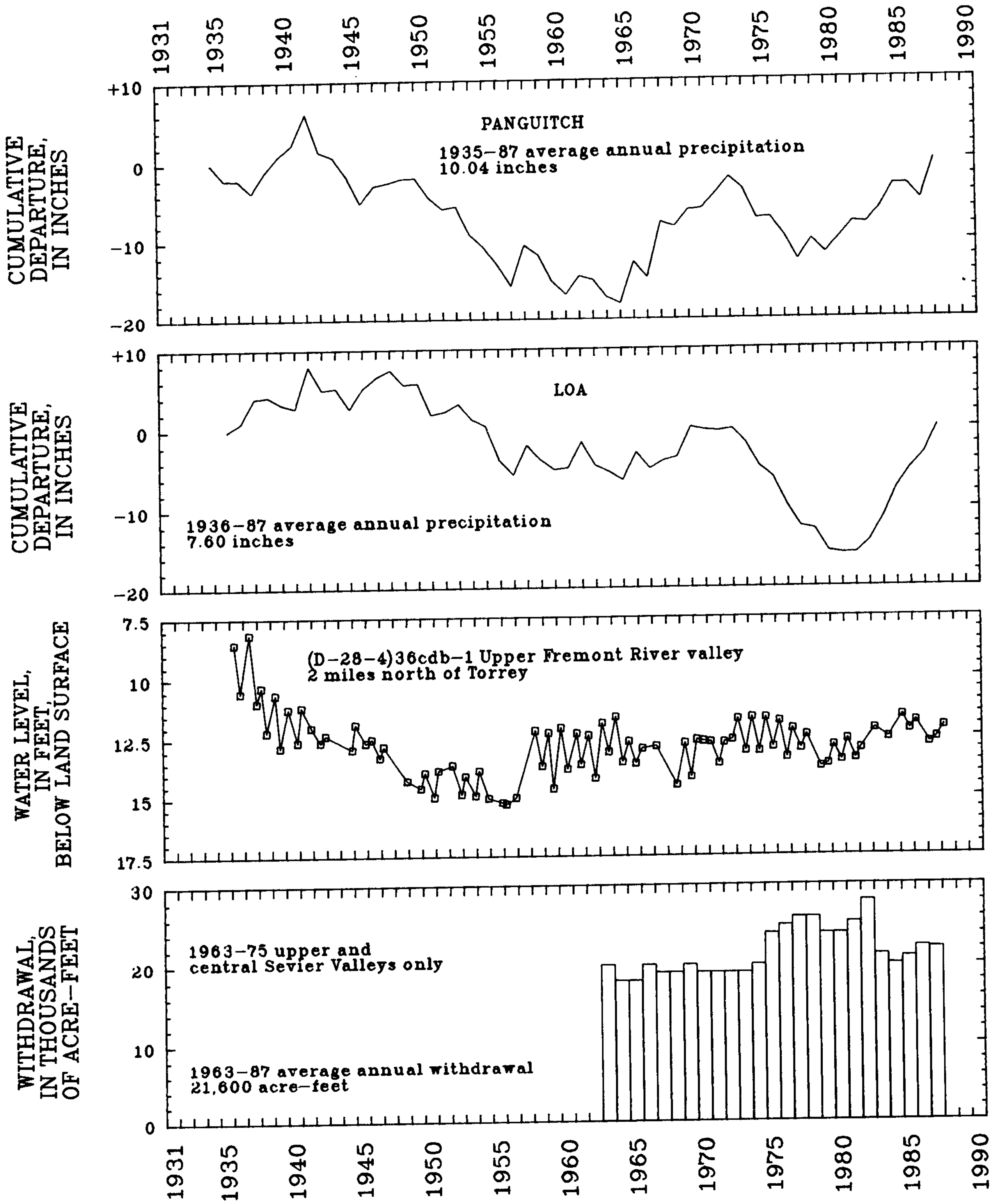

Figure 25.—Continued

PAHVANT VALLEY

By Susan Thiros

Withdrawal of water from wells in Pahvant Valley in 1987 was about 66,000 acre-feet, which was 6,000 acre-feet more than reported for 1986, and 4,000 acre-feet less than the average annual withdrawal for 1977-86 (table 2). The change from 1986 to 1987 was mainly due to increased withdrawals for irrigation. The flowing-well discharge decreased from about 22,000 acre-feet in 1986 to about 19,000 in 1987.

Water levels generally rose in the northeastern and southwestern parts of Pahvant Valley (fig. 26) possibly due to local reductions in withdrawals of ground water. The largest observed rise, almost 6 feet, occurred west of Kanosh.

The decline in water levels in other parts of the valley in 1987 (fig. 26) is attributed to increases in local withdrawals and to the decrease in precipitation in 1987 as compared to 1986. The maximum observed decline of about 17 feet was recorded in a well west of Holden.

The relation of water-levels in selected observation wells to precipitation at Fillmore and to annual withdrawals from wells is shown in figure 27. Precipitation at Fillmore in 1987 was 14.86 inches, which is 0.18 inches below the average annual precipitation for 1931-87 (fig. 27).

Concentrations of dissolved solids in water from two wells in Pahvant Valley are shown in figure 28. Both show a decrease in dissolved-solids concentrations when compared to the last reported values. Decreased concentrations are probably related to above-average precipitation and recharge during 1980-86.

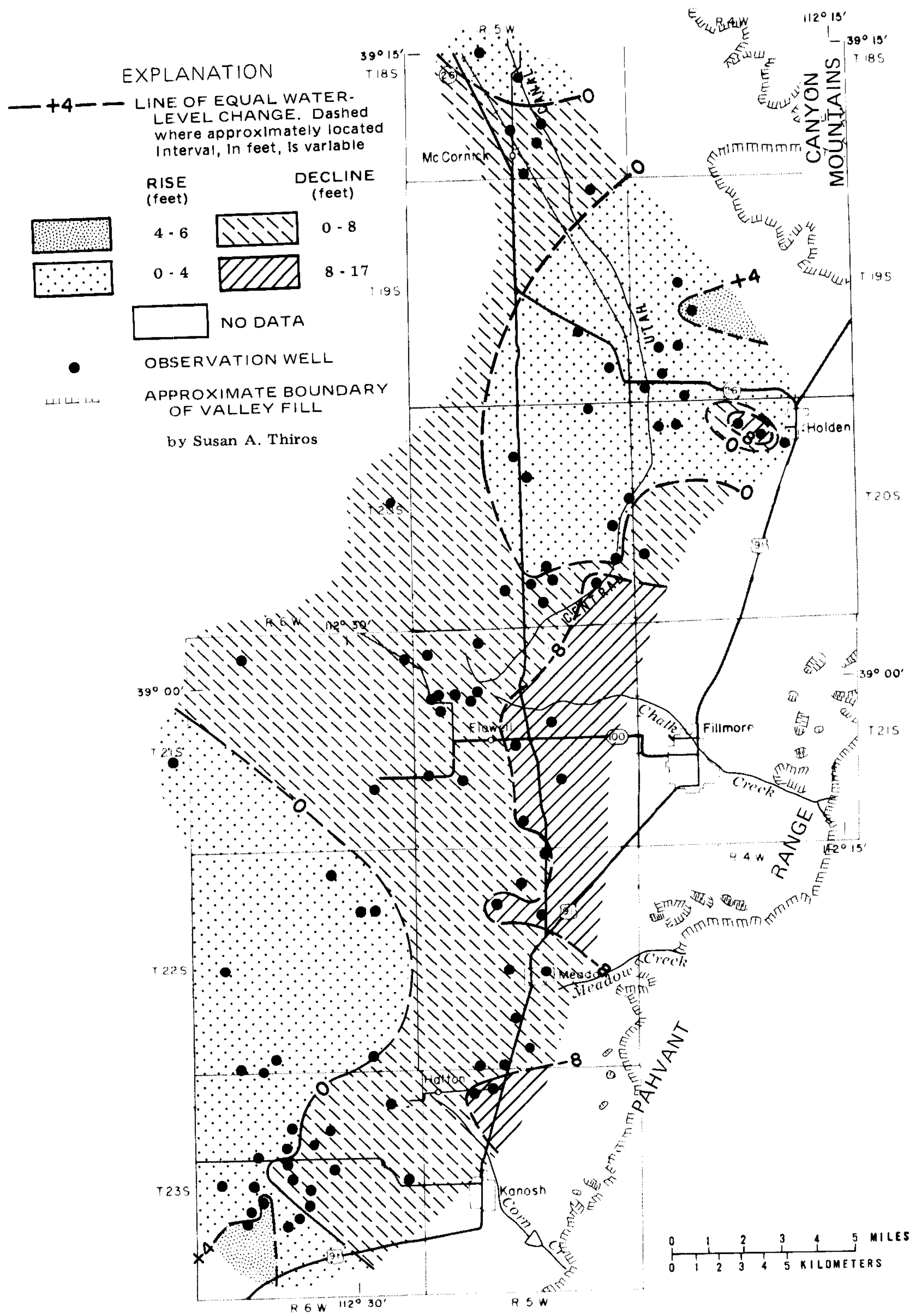

Figure 26.—Map of Pahvant Valley showing change of water levels from March 1987 to March 1988.

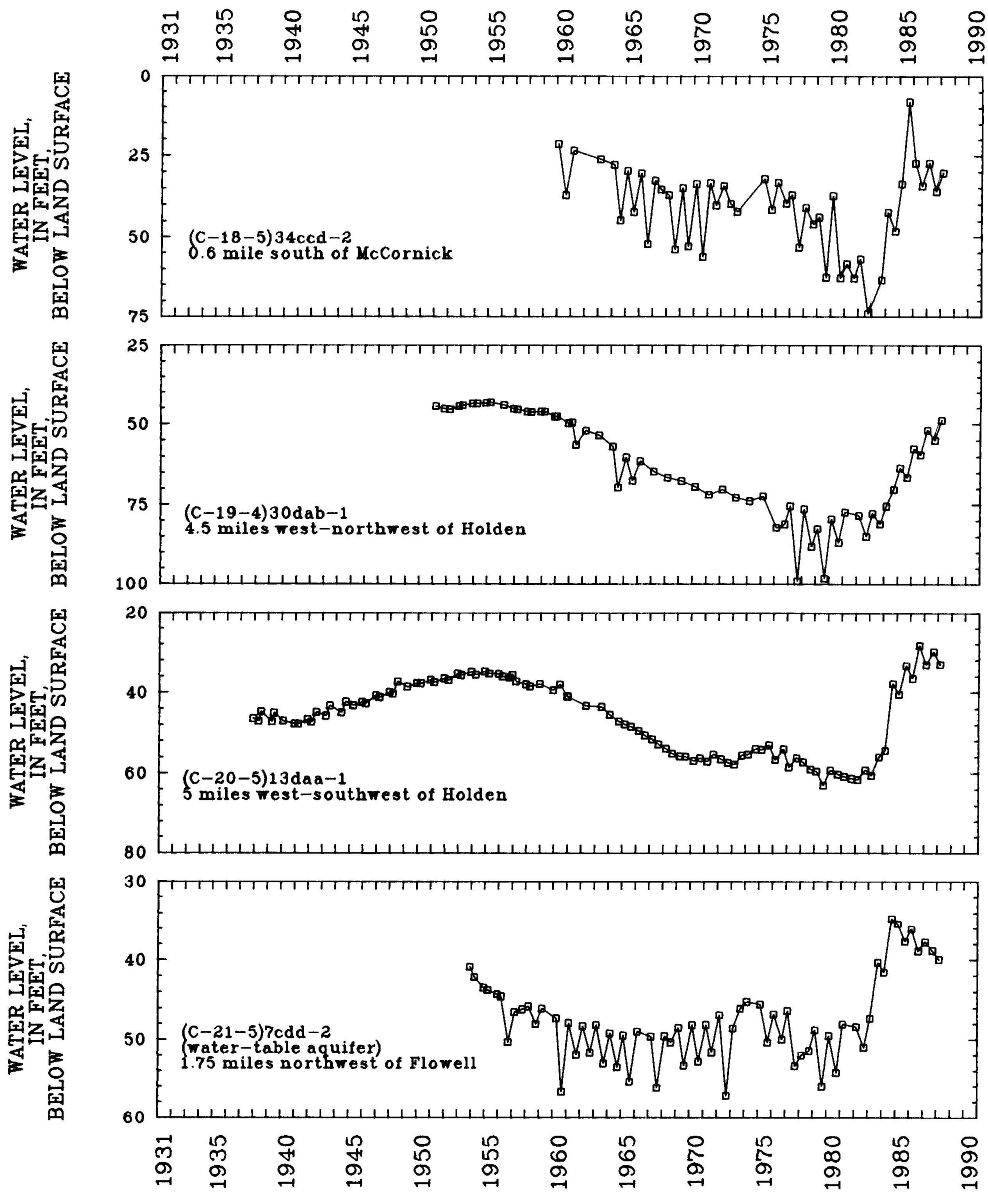

Figure 27.—Relation of water levels in selected wells in Pahvant Valley to cumulative departure from average annual precipitation at Fillmore and to annual withdrawals from wells.

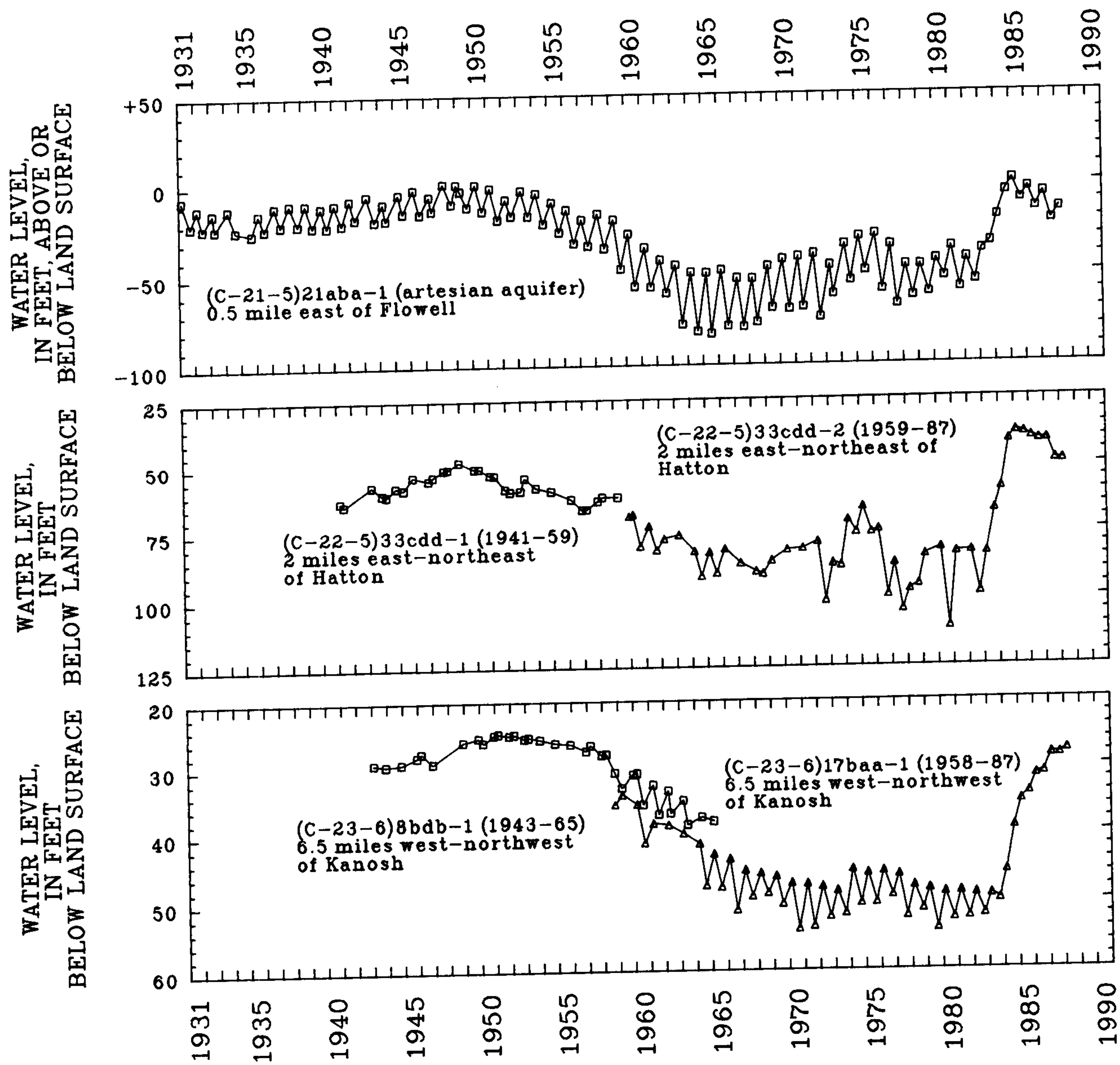

Figure 27.—Continued

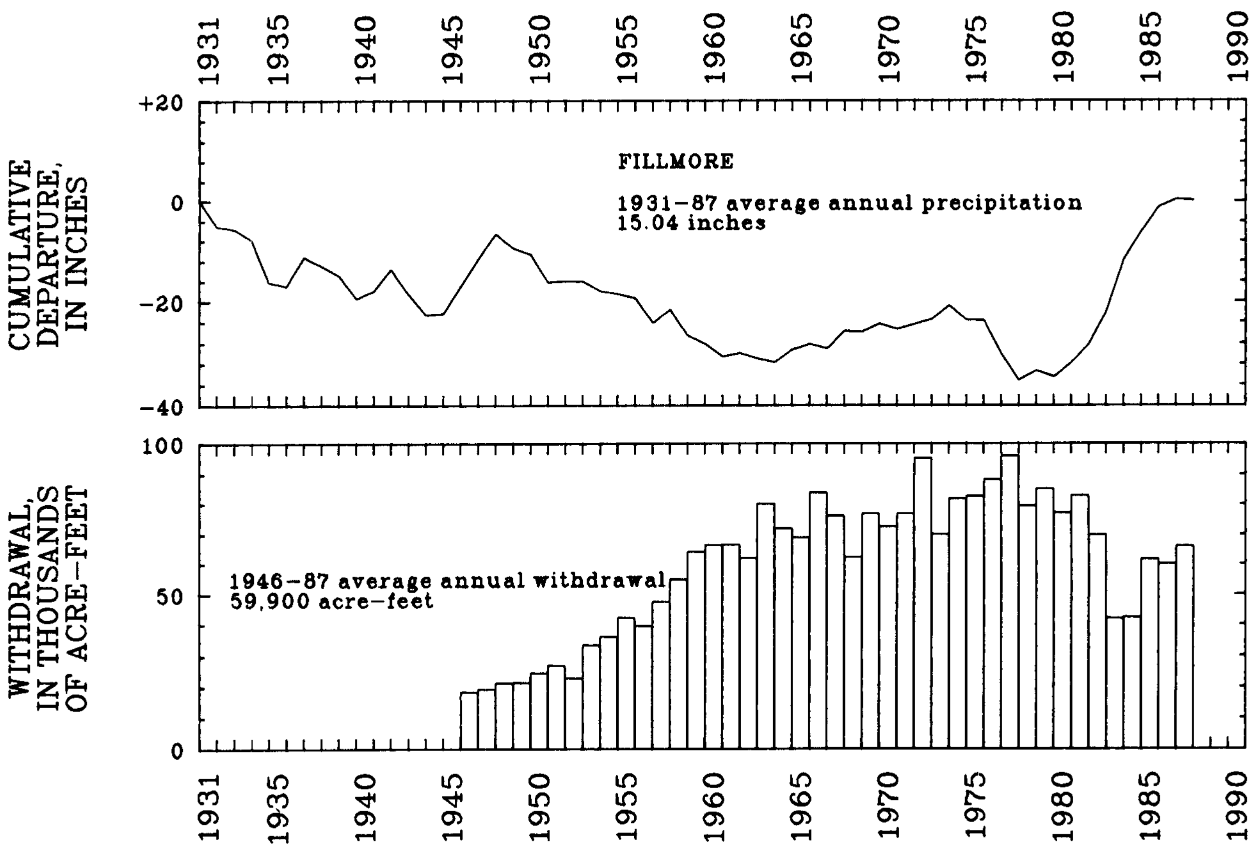

Figure 27.—Continued

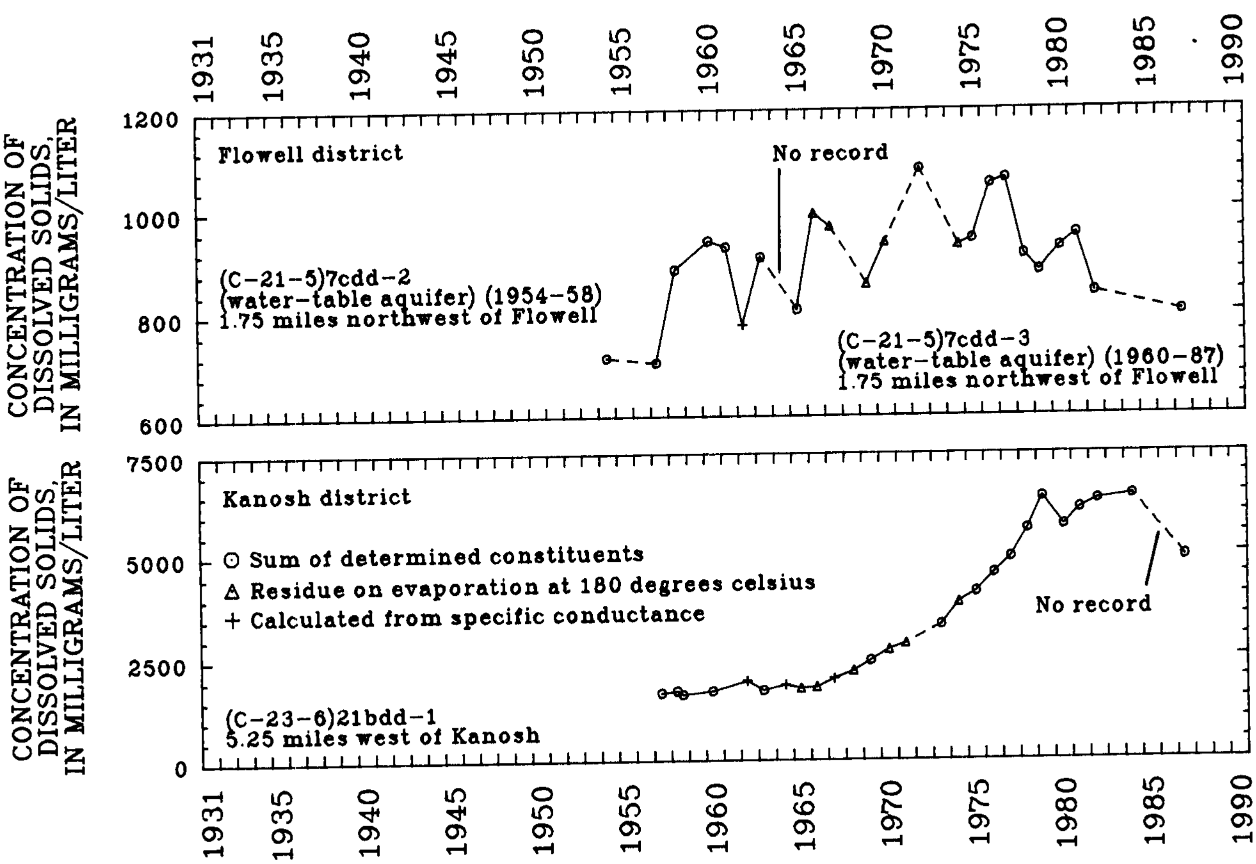

Figure 28.—Concentrations of dissolved solids in water from selected wells in Pahvant Valley.

CEDAR VALLEY, IRON COUNTY

by D. C. Emett

Withdrawal of water from wells in Cedar Valley, Iron County (formerly referred to in this series of reports as Cedar City Valley), during 1987 was about 21,000 acre-feet, which is 2,000 acre-feet more than 1986 and 6,000 acre-feet less than the average annual withdrawal for 1977-86 (table 2).

Water-level changes were less than one foot in much of the valley from March 1987 to March 1988 (fig. 29). Rises of as much as one foot occurred in the northern and western parts of the valley. The largest rises, up to 1.5 feet, were measured in two wells near Enoch. Declines of up to 3.2 feet were measured northwest of Cedar City in the center of an irrigated area and probably resulted from an increase in withdrawal of ground water for irrigation in 1987 as compared to 1986.

The relation of water levels in well (C-35-11)33aac-1 to precipitation at Cedar City FAA Airport, to discharge of Coal Creek near Cedar City, and to annual withdrawals of water from wells is shown in figure 30. Discharge from Coal Creek was 24,700 acre-feet in 1987, which is 500 acre-feet less than in 1986 and about 400 acre-feet more than the average annual discharge from 1939-87.

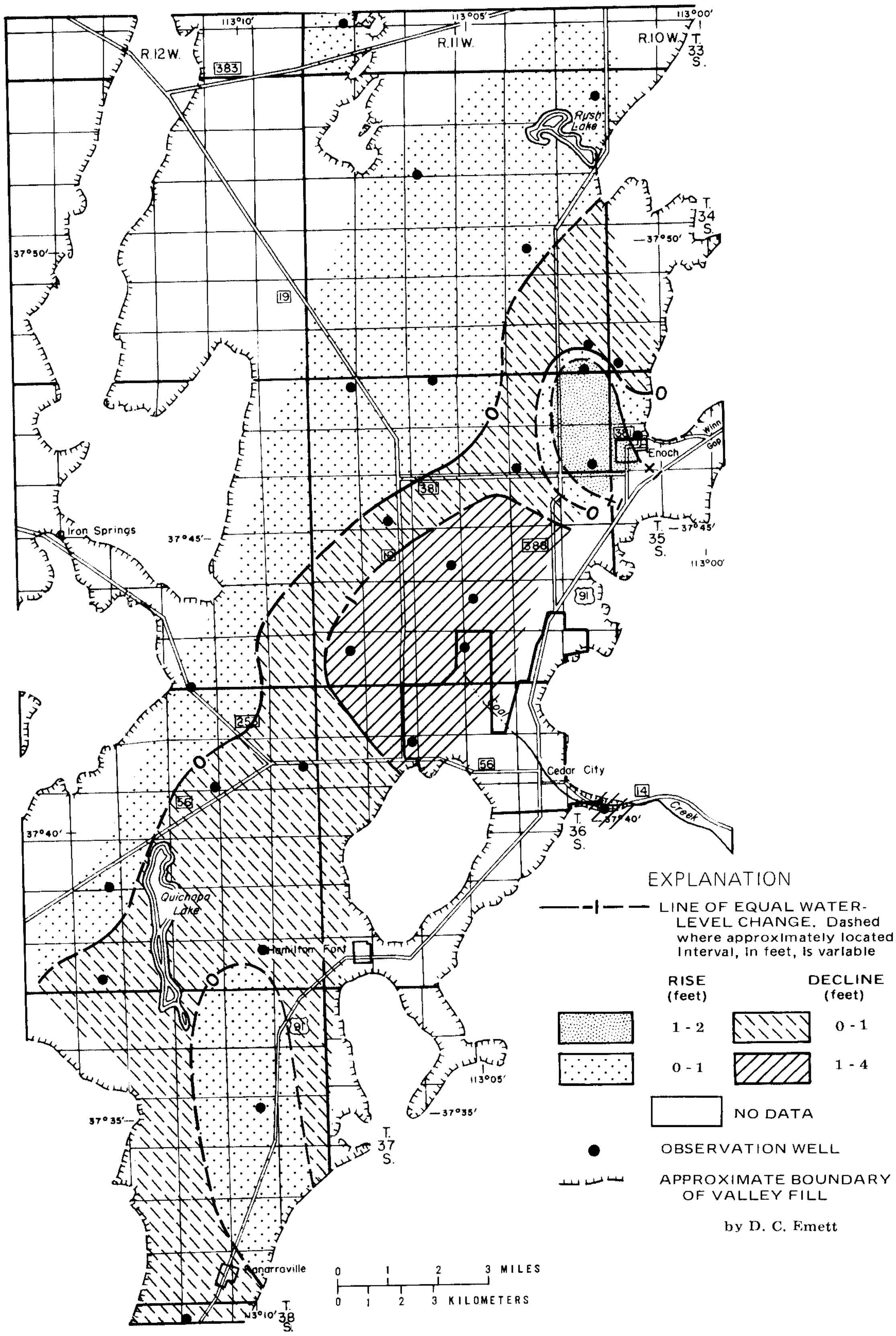

Figure 29.--Map of Cedar Valley, Iron County, showing change of water levels from March 1987 to March 1988.

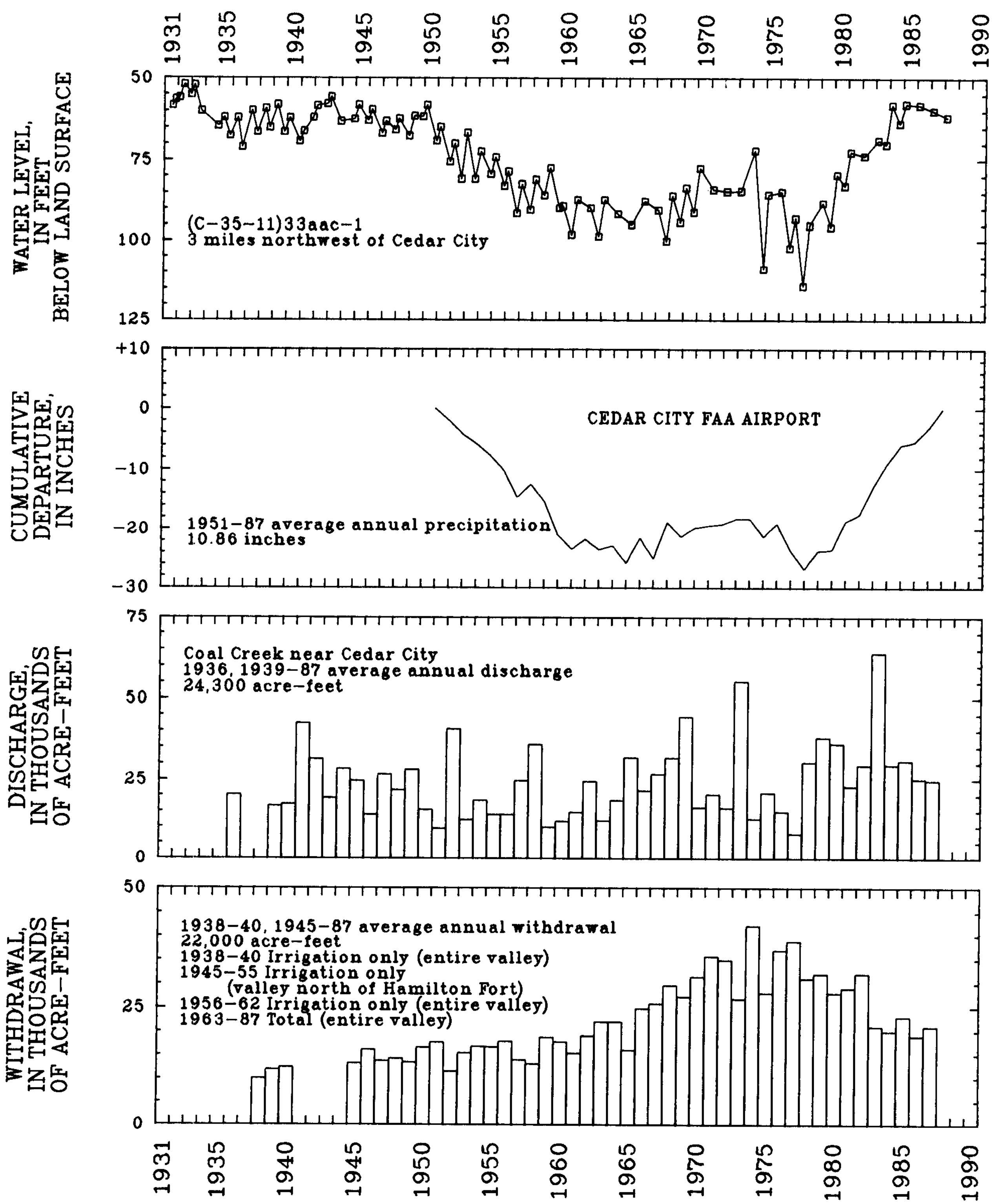

Figure 30.—Relation of water levels in well (C-35-11)33aac-1 in Cedar Valley, Iron County, to cumulative departure from the average annual precipitation at the Cedar City FAA Airport, to discharge of Coal Creek near Cedar City, and to annual withdrawals from wells.

PAROWAN VALLEY

by G. W. Sandberg

Withdrawal of water from wells in Parowan Valley was about 22,000 acre-feet in 1987. This was about 2,000 acre-feet less than was reported in 1986 and 5,000 acre-feet less than the average annual withdrawal for 1977-86 (table 2). Withdrawals for irrigation decreased while withdrawals for other uses remained about the same.

Water levels rose slightly from March 1987 to March 1988 in an area north of Summit and in the extreme northern part of the valley (fig. 31). The rises were probably due to local decreases in pumpage. Declines throughout the rest of the area were probably caused by pumpage.

The relation of water levels in well (C-34-8)5bca-1 to cumulative departure from the average annual precipitation at Parowan Power Plant and to annual withdrawals from wells is shown in figure 32. Although precipitation at Parowan Power Plant increased in 1987 compared to 1986, the water level in well (C-34-8)5bca-1 declined about two feet during the year. The decline probably was caused by local pumping.

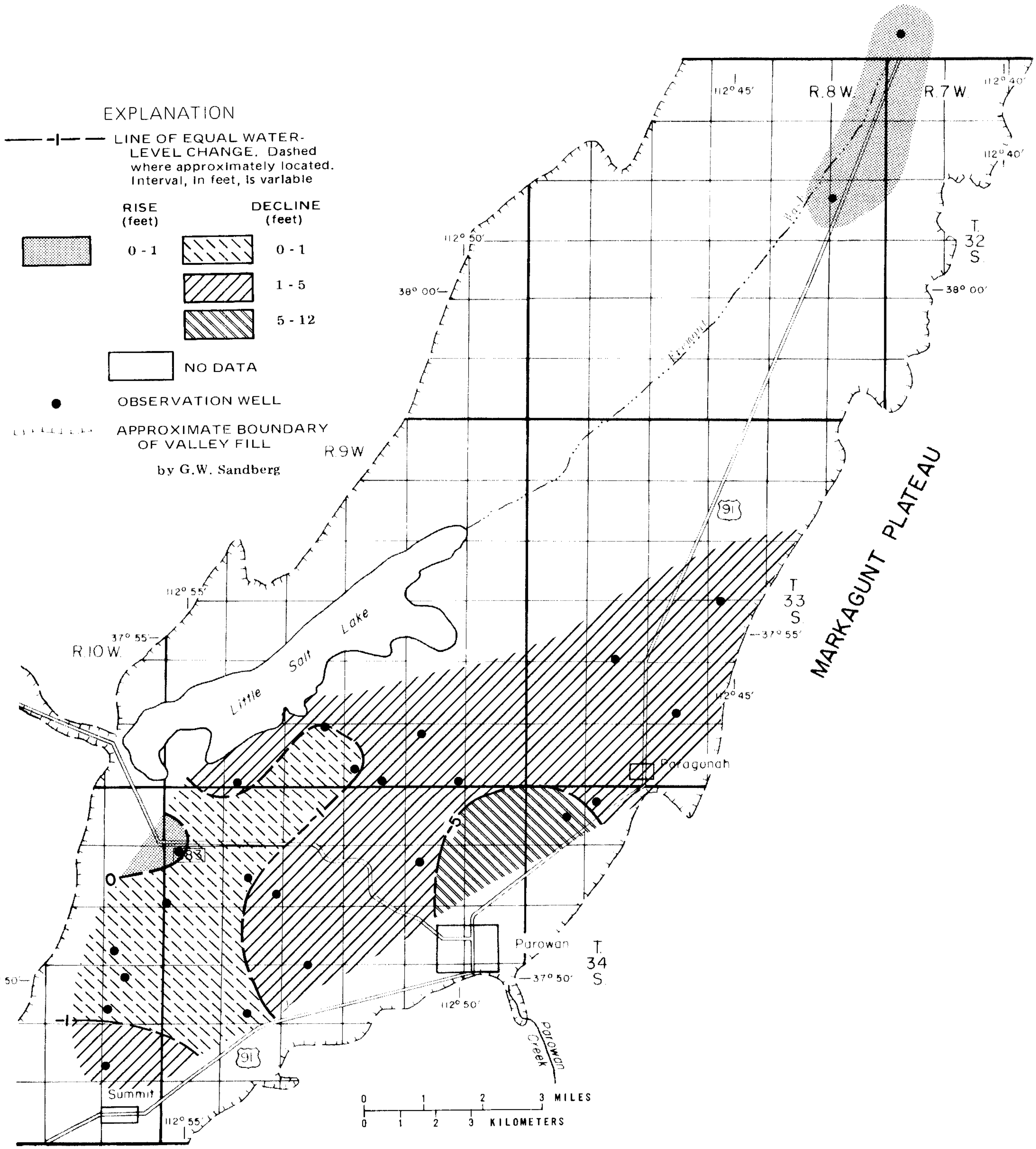

Figure 31.—Map of Parowan Valley showing change of water levels from March 1987 to March 1988.

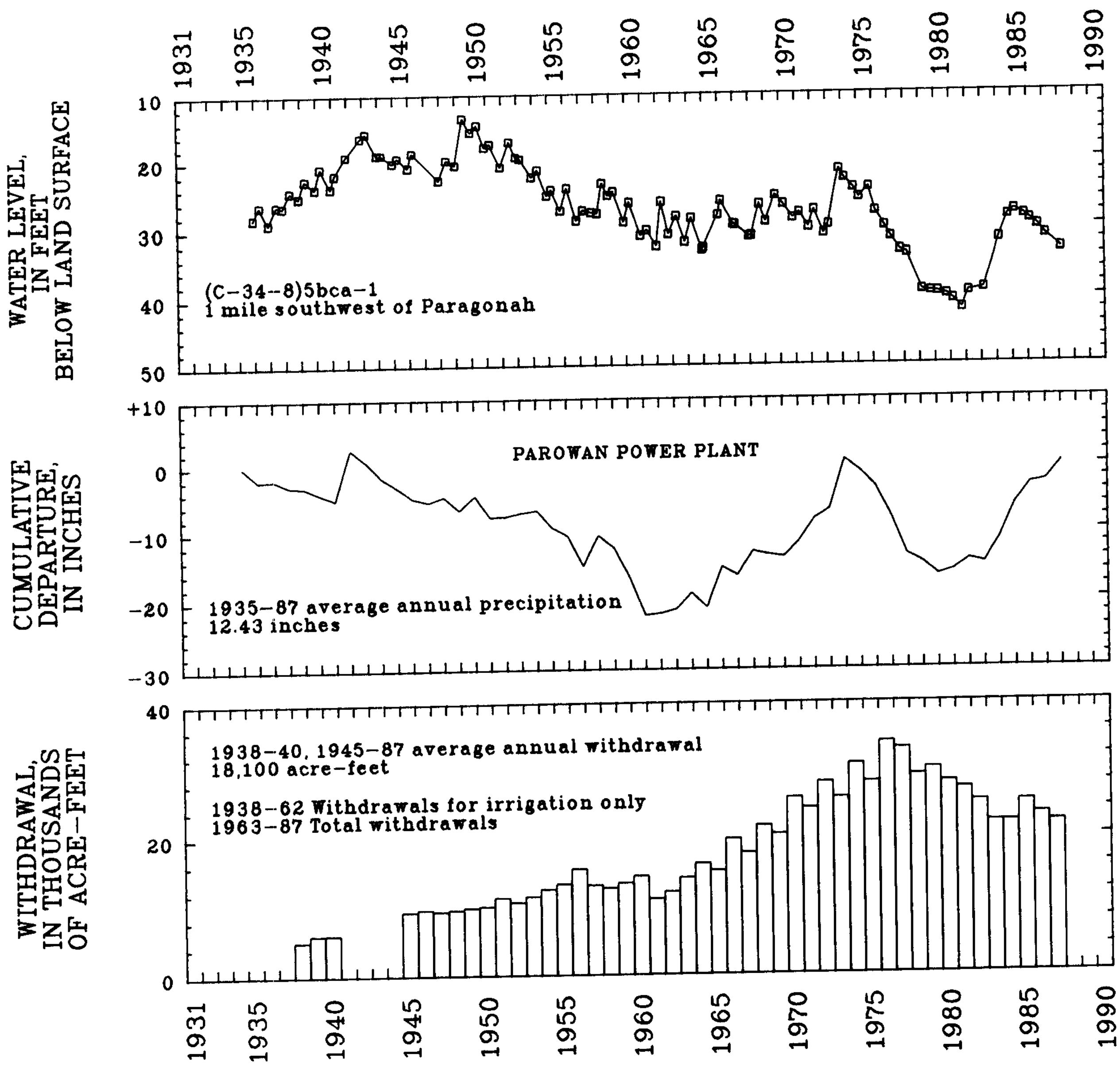

Figure 32.—Relation of water levels in well (C-34-8)5bca-1 in Parowan Valley to cumulative departure from the average annual precipitation at Parowan Power Plant and to annual withdrawals from wells.

Milford area

by R. W. Puchta

Withdrawal of water from wells in the Milford area in 1987 was about 44,000 acre-feet, which is 2,000 acre-feet less than the 1986 withdrawal and 8,000 acre-feet less than the 1977-86 average annual withdrawal (table 2).

Water levels declined from March 1987 to March 1988 in most of the area in which ground water was pumped (fig. 33). Declines of more than one foot occurred throughout most of the area south of Milford. The largest declines, nearly 5 feet, occurred in a small area northeast of Minersville and in the pumped area south of Milford.

Water-level declines may be related to local increases in pumping and/or the reduction in flow of, and resulting reduced recharge from, the Beaver River in 1987 as compared to 1986. Discharge from the Beaver River was 31,000 acre-feet in 1987, 15,500 acre-feet less than the previous year, but 1,000 acre-feet more than the 1931-87 average annual discharge.

Water levels rose slightly in the southern and northeastern parts of the Milford area. A rise of nearly 7 feet was measured in a well northeast of Milford. Water-level rises may be related to the increase in precipitation in 1987 as compared to 1986 and to local decreases in ground-water withdrawals. Precipitation at the Milford Airport for 1987 was 10.26 inches, 1.30 inches above the average annual precipitation for 1932-87.

The relation of water levels in wells (C-29-10)6ddc-1 and (C-29-11)13add-1 to precipitation at Milford Airport, to discharge of the Beaver River at Rocky Ford Dam, and to annual withdrawals of water from wells is shown in figure 34.

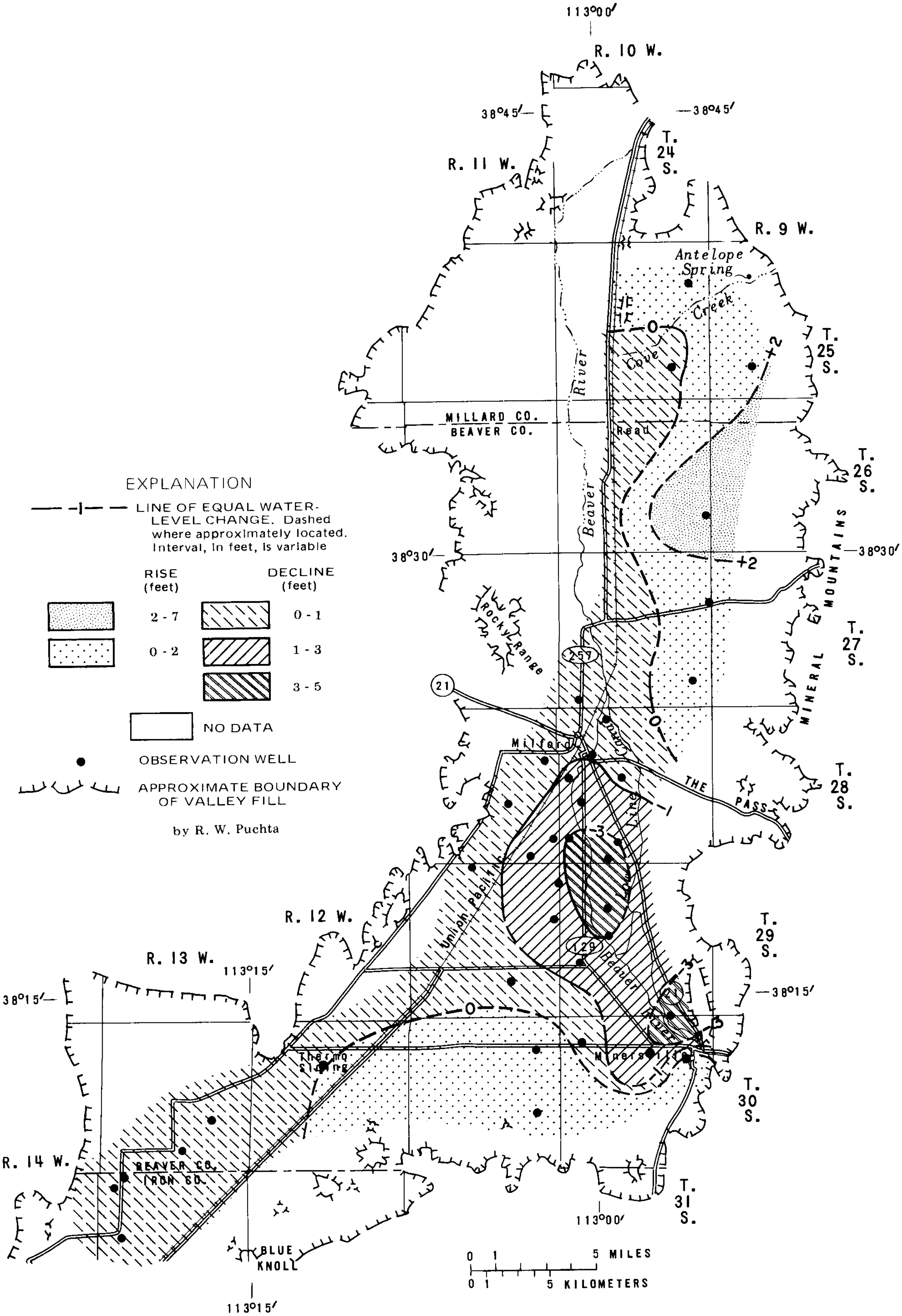

Figure 33.—Map of the Milford area showing change of water levels from March 1987 to March 1988.

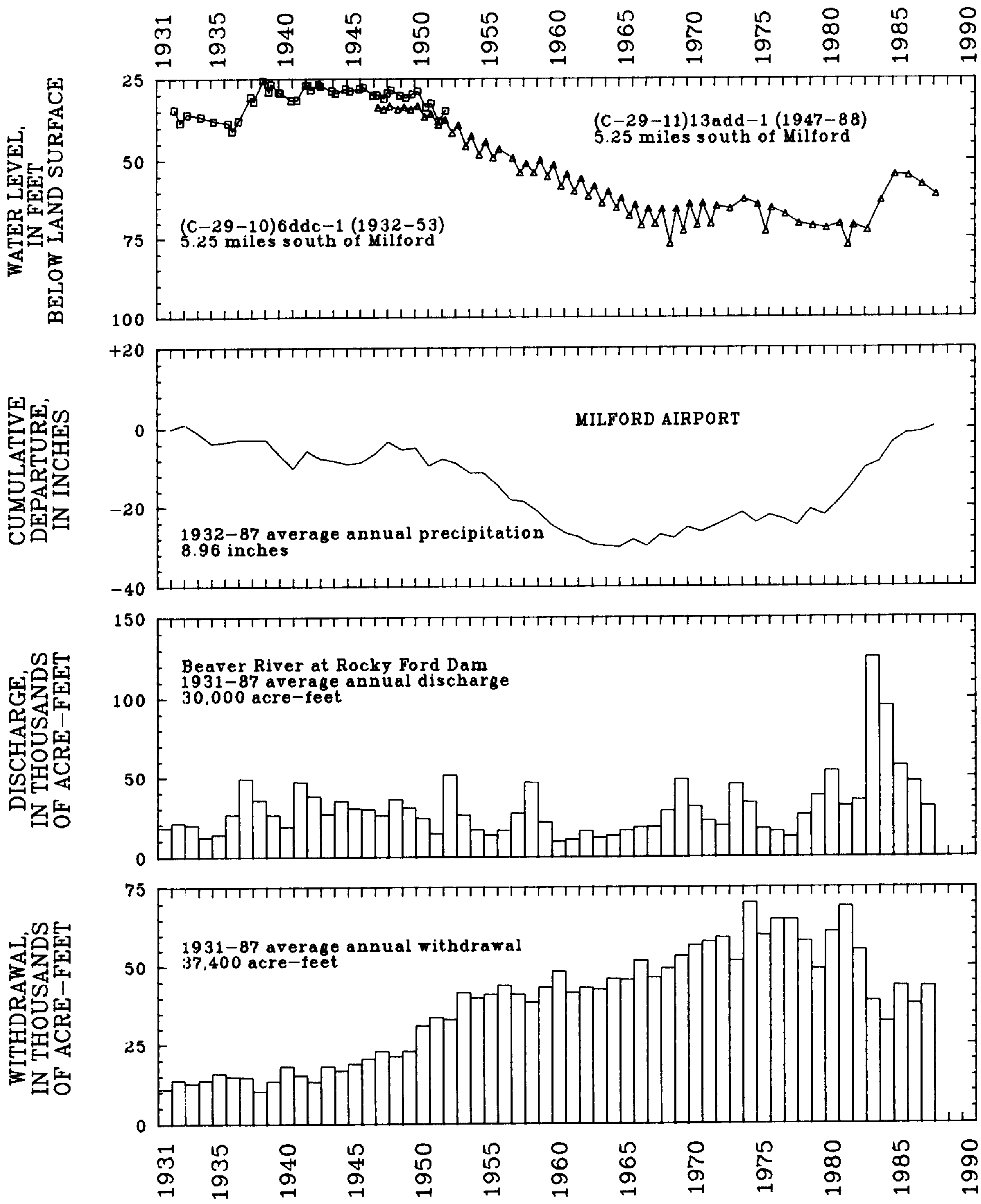

Figure 34.—Relation of water levels in wells (C-29-10)6ddc-1 and (C-29-11)13add-1 in the Milford area to cumulative departure from the average annual precipitation at Milford Airport, to discharge of the Beaver River at Rocky Ford Dam, and to annual withdrawals from wells.

Beryl-Enterprise area

By G. W. Sandberg

Withdrawal of water from wells in the Beryl-Enterprise area in 1987 was about 97,000 acre-feet, an increase of 4,000 acre-feet from 1986 and 10,000 acre-feet more than the average annual withdrawal for 1977-86 (table 2). Pumpage for irrigation remained about the same and the pumpage for industrial use, which was mostly for dewatering a mine area, increased by 3,900 acre-feet. Most of the 23,000 acre-feet of water pumped to dewater the mine area was returned to the ground-water reservoir as recharge in an adjacent area.

Water levels declined from March 1987 to March 1988 in essentially all of the area because of continued large withdrawals (fig. 35). Water levels rose slightly in small areas on the western, eastern, and northern borders of the valley where water is used mostly for stock watering.

The relation of water levels in wells (C-35-17)25dcd-1 and (C-35-17)25cdd-1 to cumulative departure from the average annual precipitation at Modena, and to annual withdrawals from wells is shown in figure 36. The concentration of dissolved solids in well (C-34-16)28dcc-2 in the northern part of the pumped area is also shown in figure 36 and shows in increase in 1987.

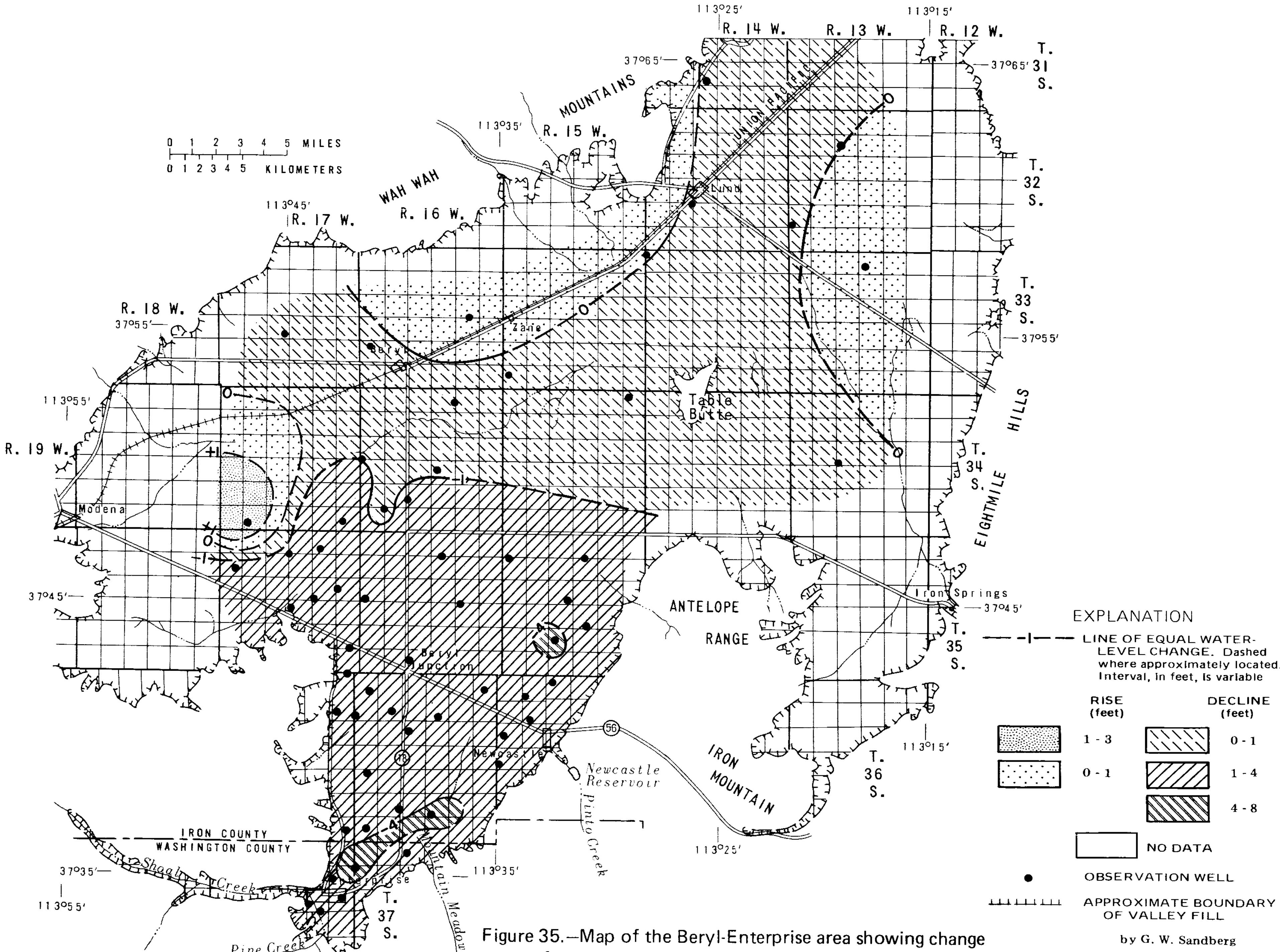

Figure 35.—Map of the Beryl-Enterprise area showing change of water levels from March 1987 to March 1988.

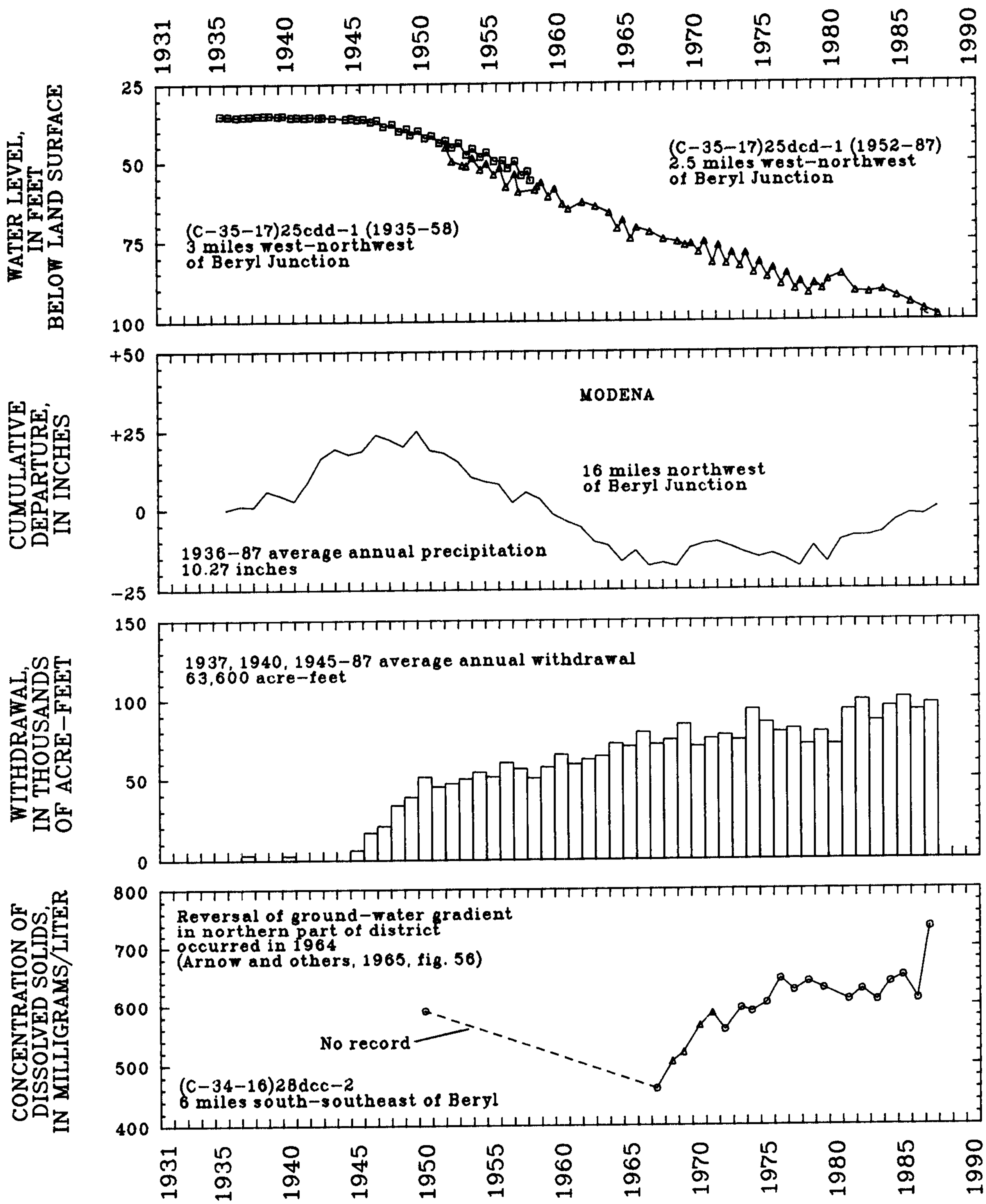

Figure 36.—Relation of water levels in wells (C-35-17)25cdd-1 and (C-35-17)25dcd-1 in the Beryl-Enterprise area to cumulative departure from the average annual precipitation at Modena, to annual withdrawals from wells, and to concentration of dissolved solids in well (C-34-16)28dcc-2.

CENTRAL VIRGIN RIVER AREA

by G. W. Sandberg

Withdrawal of water from wells in the Central Virgin River area was about 20,000 acre-feet in 1987, equal to that for 1986 (table 2). This includes both water withdrawn from valley-fill aquifers, most of which is used for irrigation, and water withdrawn from consolidated rocks, most of which is used for public supply. Water use for irrigation decreased slightly from 1986 to 1987, and use for public supply increased. The decrease for irrigation is attributed to the conversion of land from agricultural to urban use.

Water-level changes from February 1987 to February 1988, mostly representing changes in valley-fill aquifers, are shown in figure 37. Water levels rose in most of the central part of the Central Virgin River area and water levels declined in the southern and northwestern parts of the area (fig. 37). The largest observed water-level rise occurred about 11 miles northeast of St. George, and the largest decline was at Santa Clara.

The relation of water levels in selected wells to discharge of the Virgin River at Virgin, to precipitation at St. George, and to annual withdrawals from wells in the Central Virgin River area is shown in figure 38. In 1987, precipitation was below average for the fourth time in 9 years, and the total annual discharge of the Virgin River was about 41,000 acre-feet below average.

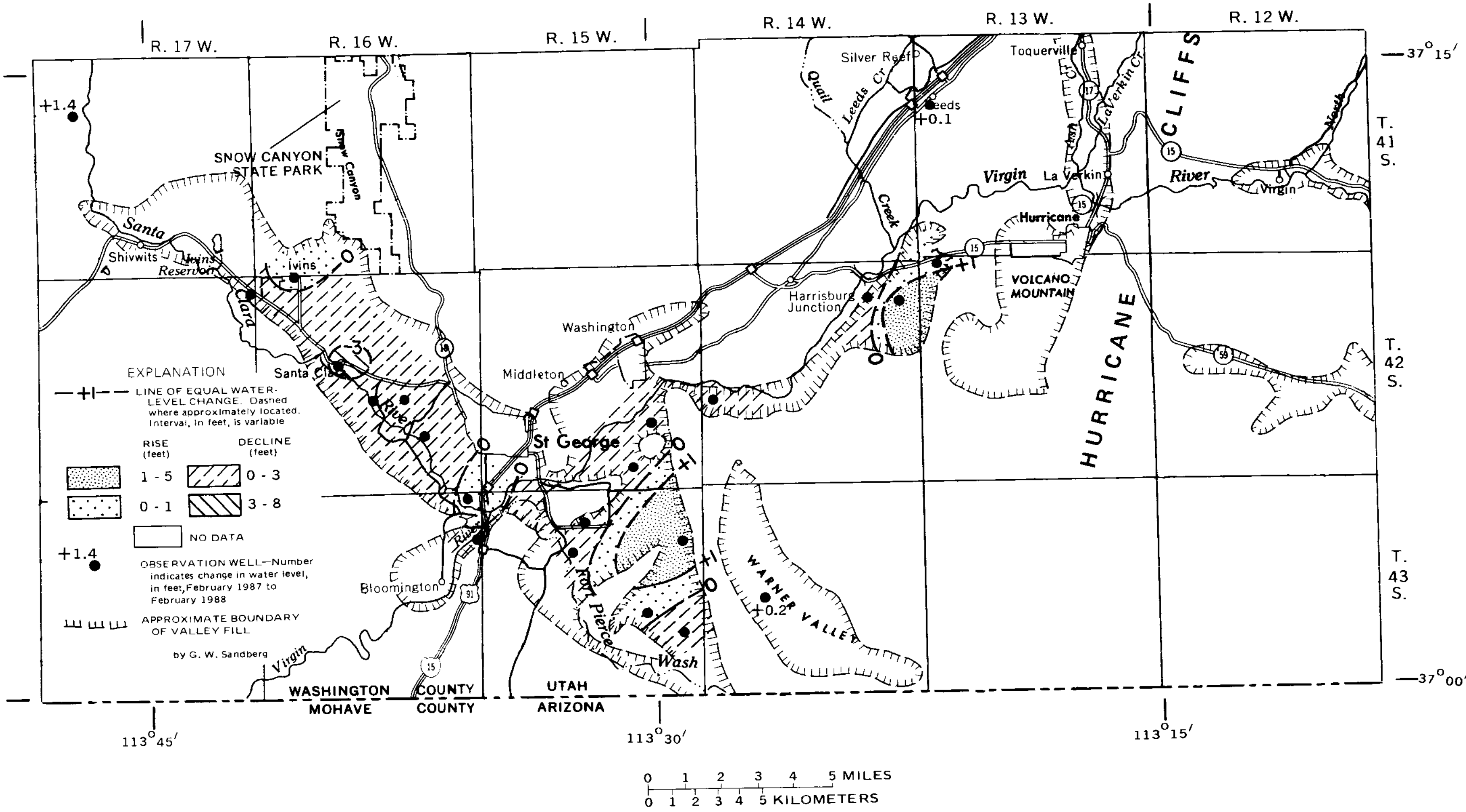

Figure 37.– Map of the Central Virgin River area showing change of water levels from February 1987 to February 1988.

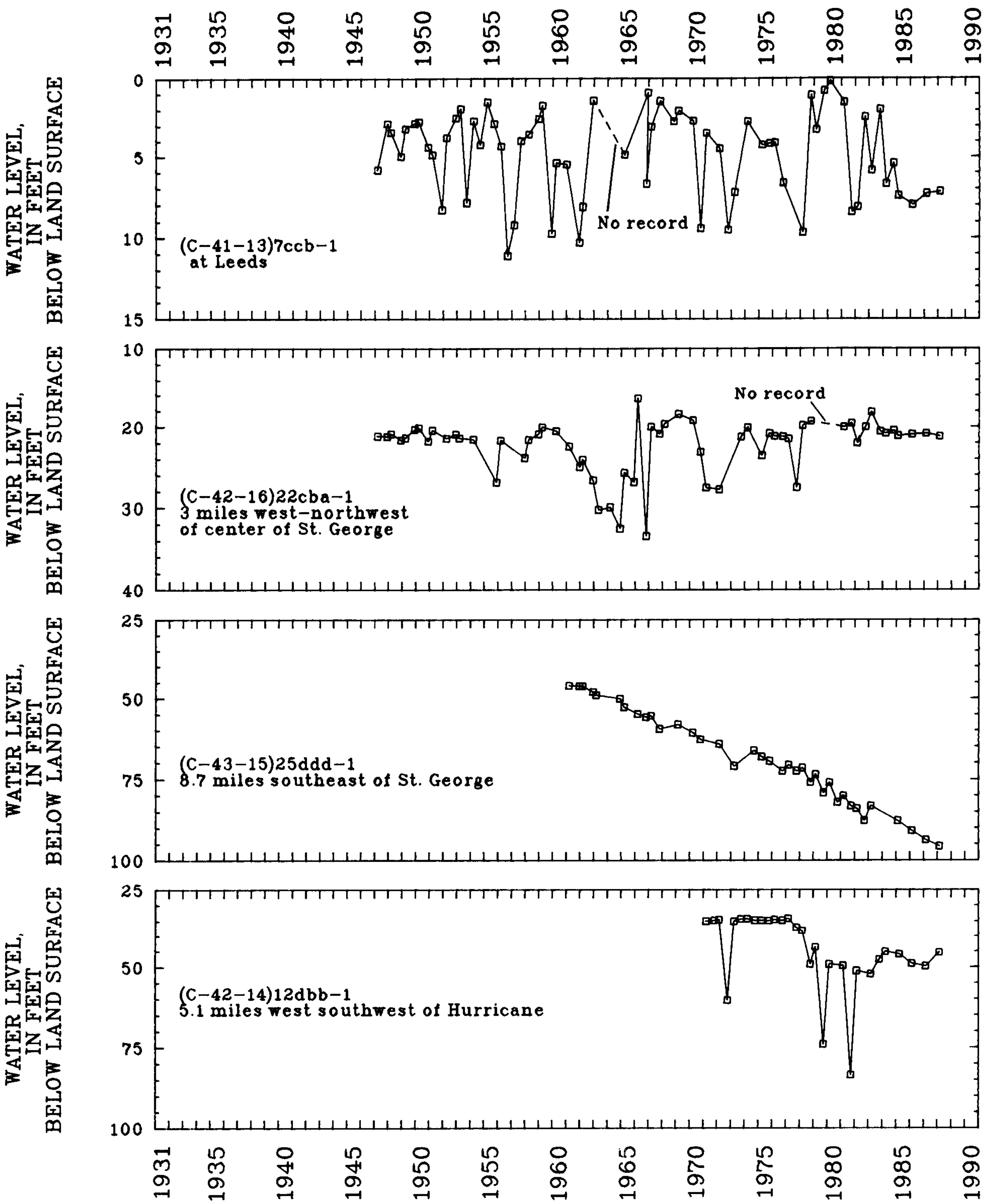

Figure 38.—Relation of water levels in selected wells to discharge of the Virgin River at Virgin, to cumulative departure from average annual precipitation at St. George, and to annual withdrawals from wells in the Central Virgin River area.

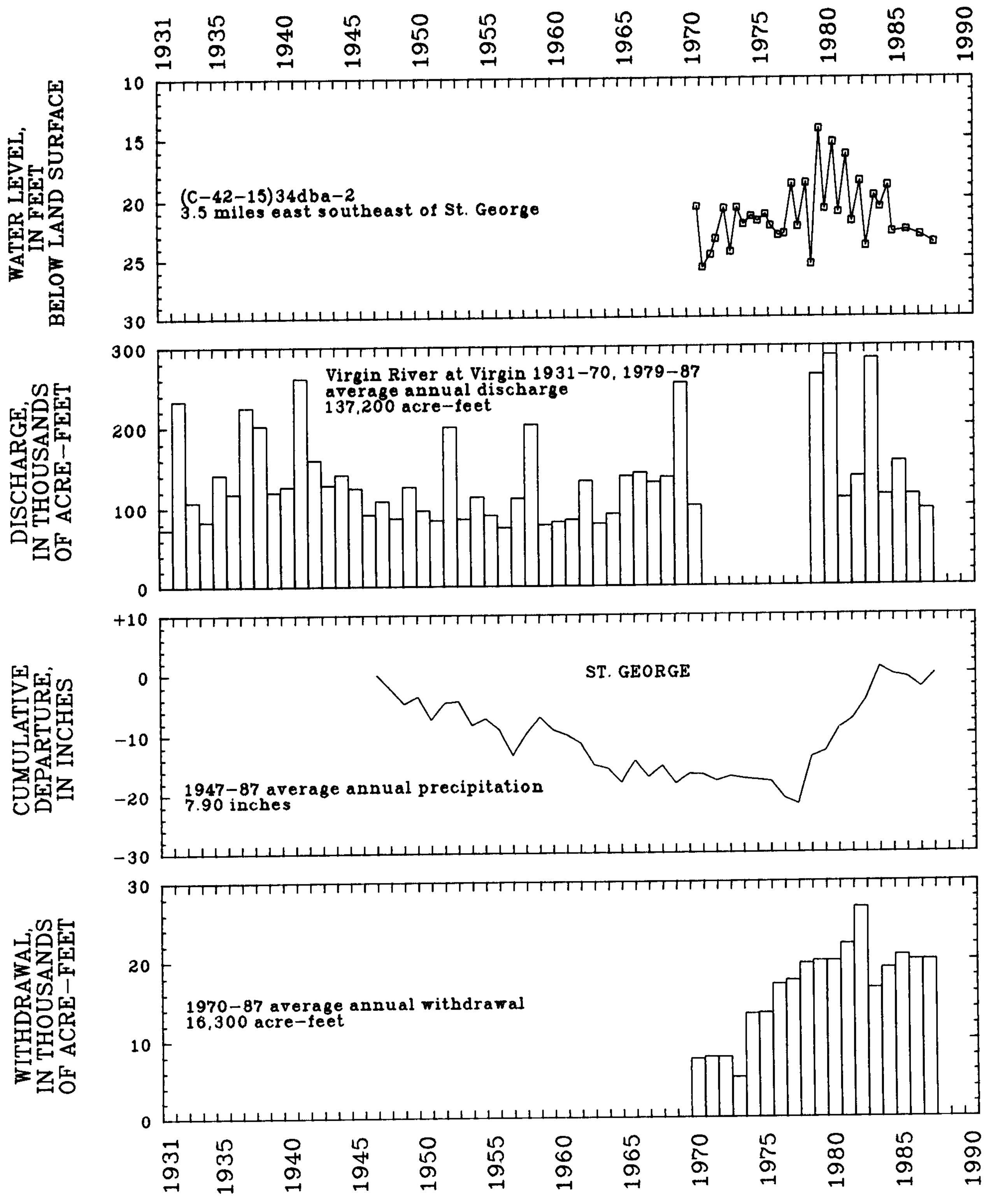

Figure 38.—Continued

OTHER AREAS

by Carole Burden

Approximately 75,000 acre-feet of water was withdrawn from wells in 1987 in those areas of Utah listed below:

Number in figure 1	Area	Estimated withdrawal (acre-feet) 1987	1986
1	Grouse Creek Valley	2,420	2,200
2	Park Valley	2,500	1,800
8	Ogden Valley	11,250	10,800
12	Dugway area Skull Valley Old River Bed	4,860	5,200
13	Cedar Valley, Utah County	1,830	2,200
18	Sanpete Valley	11,570	8,300
23	Snake Valley	4,440	4,600
25	Beaver Valley	6,800	7,000
	Remainder of State	29,200	25,900
Total (rounded)		75,000	68,000

The total withdrawal was 7,000 acre-feet more than in 1986 and 6,000 acre-feet less than the average annual withdrawal for 1977-86 (table 2). Withdrawals were less in Cedar Valley (Utah County), Snake Valley, Beaver Valley, and in the Dugway, Skull Valley and Old River Bed areas. These decreases were mainly due to above-average precipitation and decreased withdrawals for irrigation and municipal use. Withdrawals increased in Ogden Valley, Grouse Creek Valley, Park Valley, and Sanpete Valley, mainly due to below-average precipitation and increased withdrawals for irrigation and municipal use.

Figures 39 and 40 show changes of water levels in Cedar Valley (Utah County) and Sanpete Valley from March 1987 to March 1988. Water levels in Cedar Valley declined in the western part of the valley in the Cedar Fort and Fairfield areas. Declines were probably due to less precipitation and streamflow available for recharge in 1987 as compared to 1986. Water levels rose in the rest of the valley. These rises probably were due to decreased withdrawals for irrigation. Water levels in Sanpete Valley generally declined. Water-level declines probably were due to the increased ground-water withdrawals.

Figure 41 shows the relation of water levels in 16 wells in selected areas of Utah to the cumulative departure from average annual precipitation at sites in or near those areas. Water levels rose in 4 of the observation wells from March 1987 to March 1988. The rises probably were due to local above-average precipitation. Water levels declined in 10 wells, probably due to either below-average precipitation or increased local withdrawals or both. Two of the observation wells were not measured in March 1988.

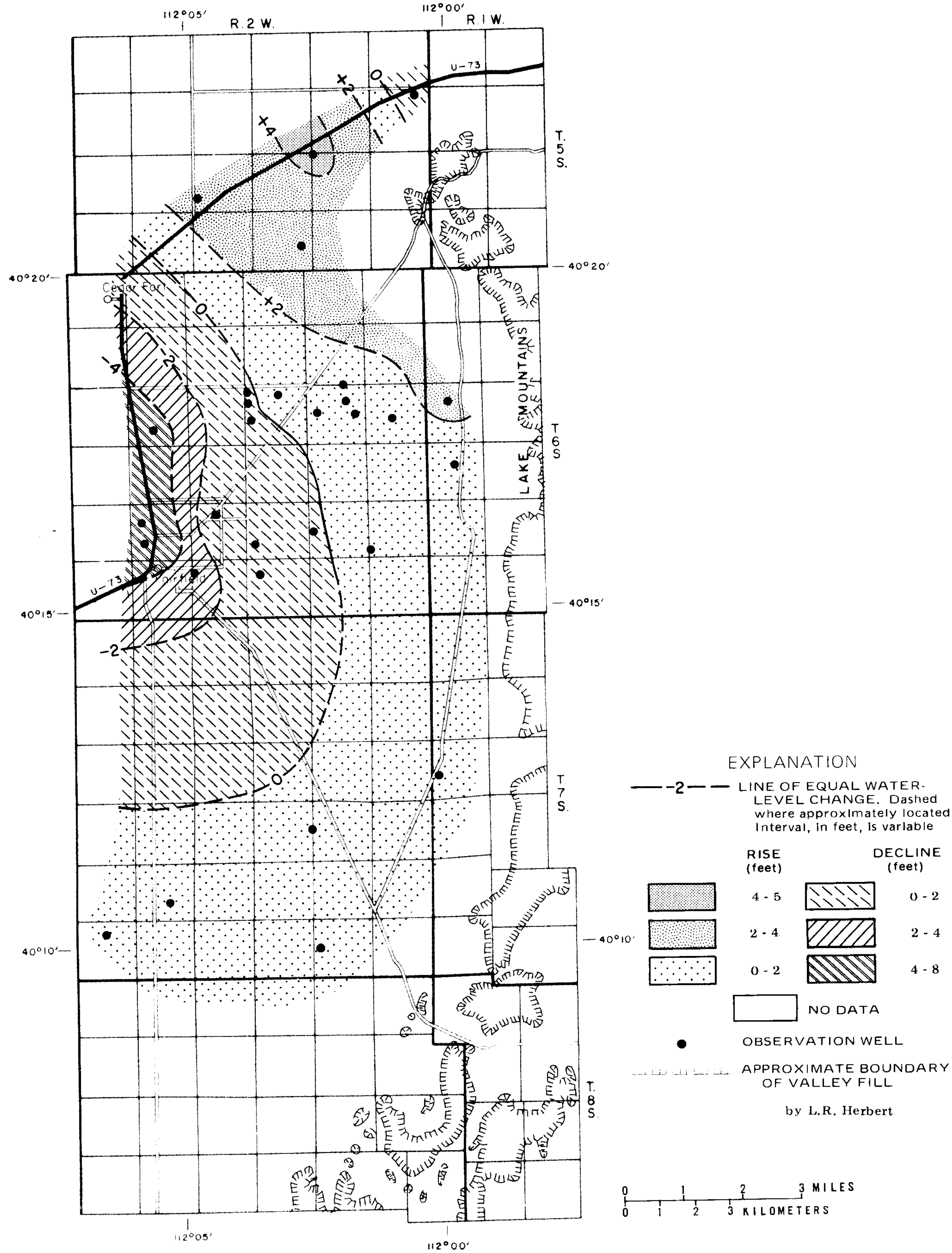

Figure 39.—Map of Cedar Valley, Utah County, showing change of water levels from March 1987 to March 1988.

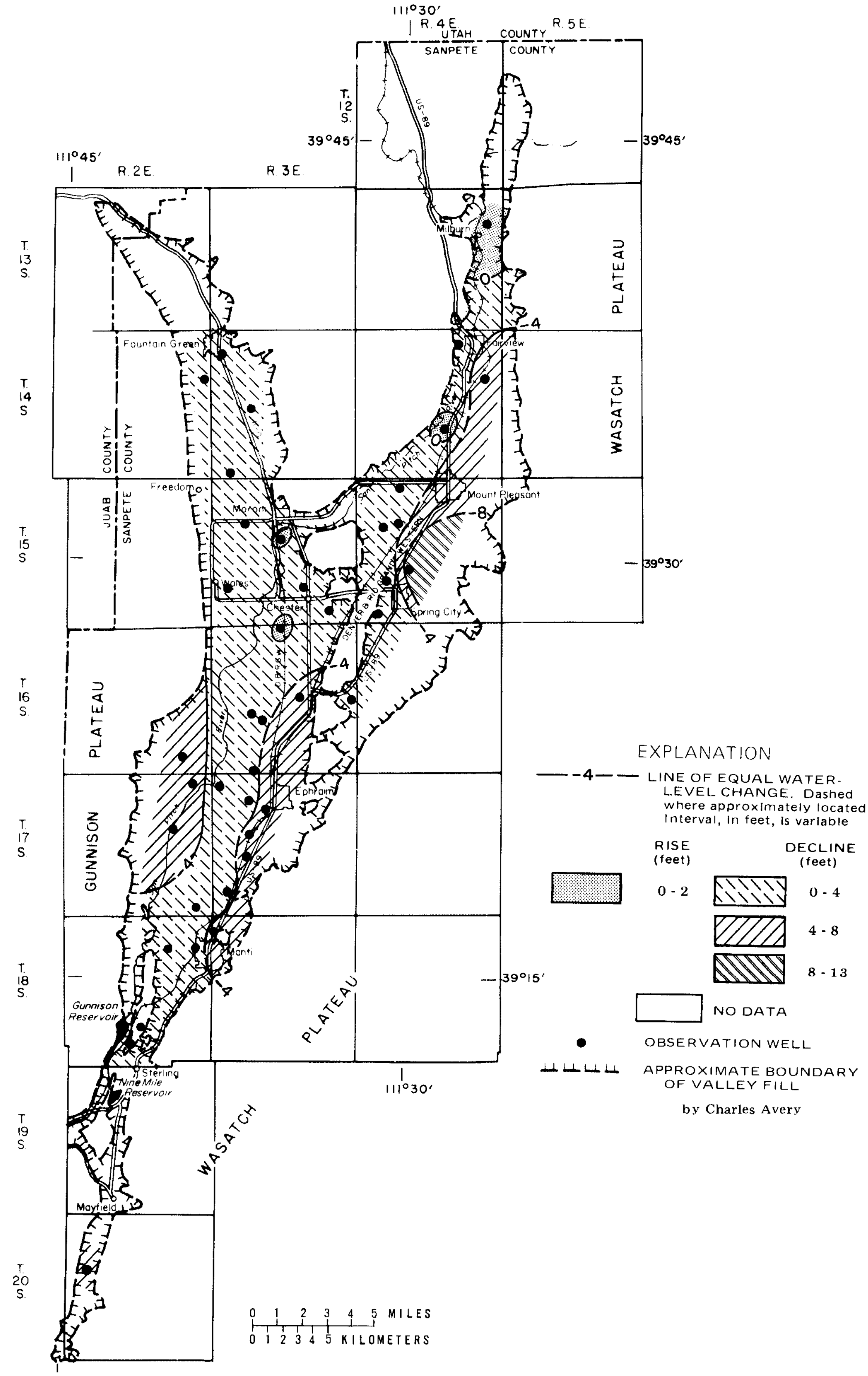

Figure 40.—Map of Sanpete Valley showing change of water levels from March 1987 to March 1988.

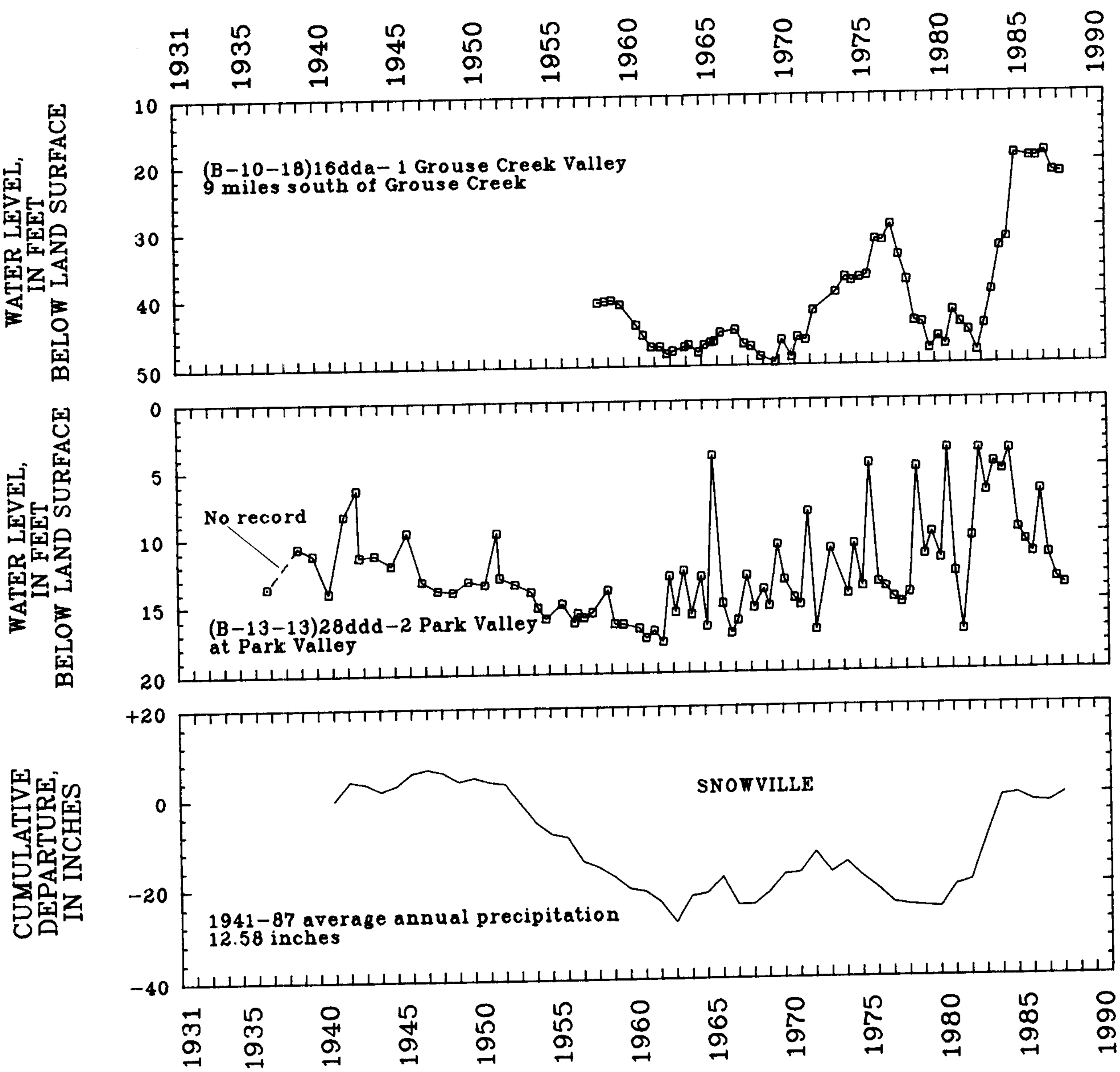

Figure 41.—Relation of water levels in wells in selected areas of Utah to cumulative departure from the average annual precipitation at sites in or near those areas.

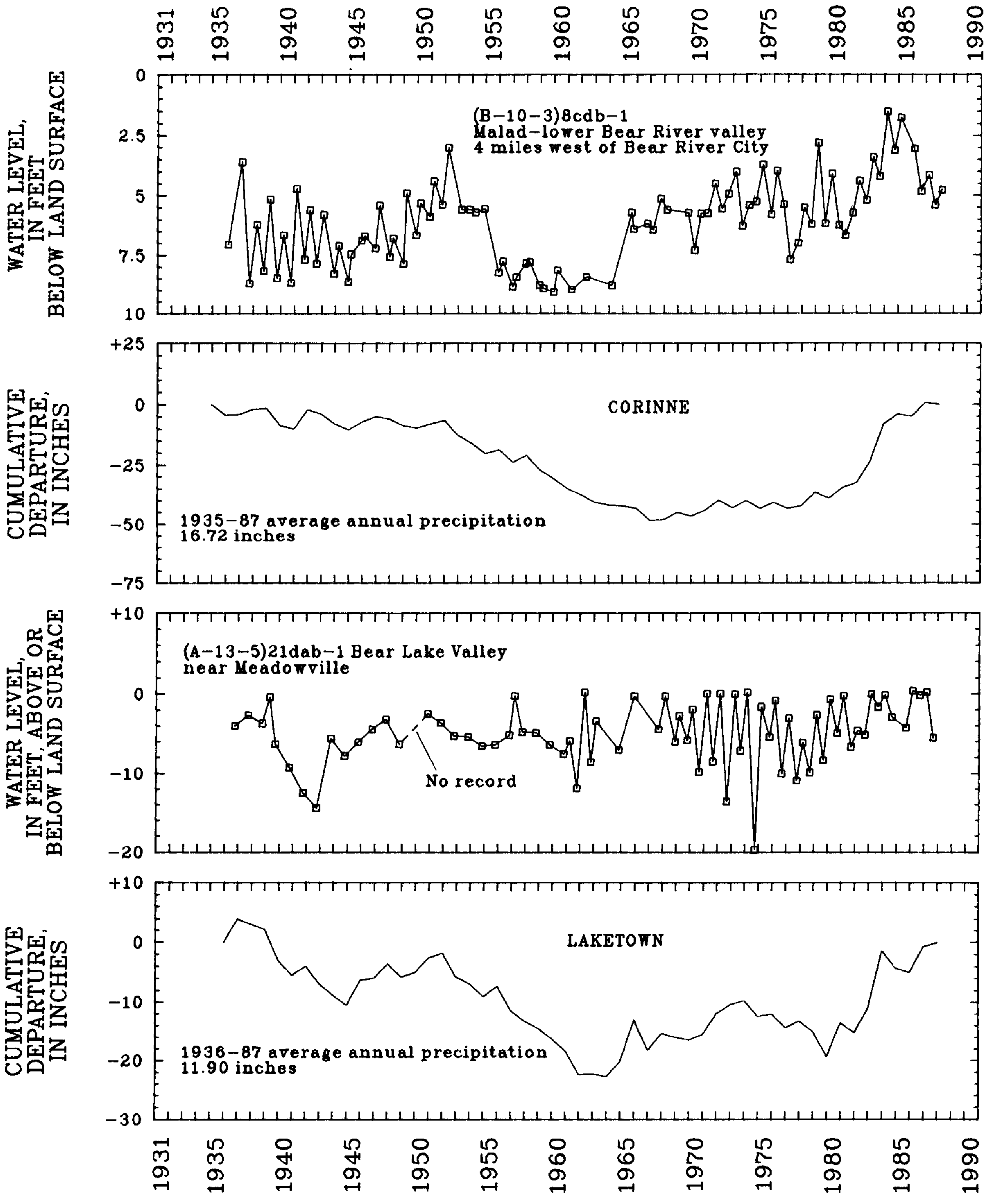

Figure 41.—Continued

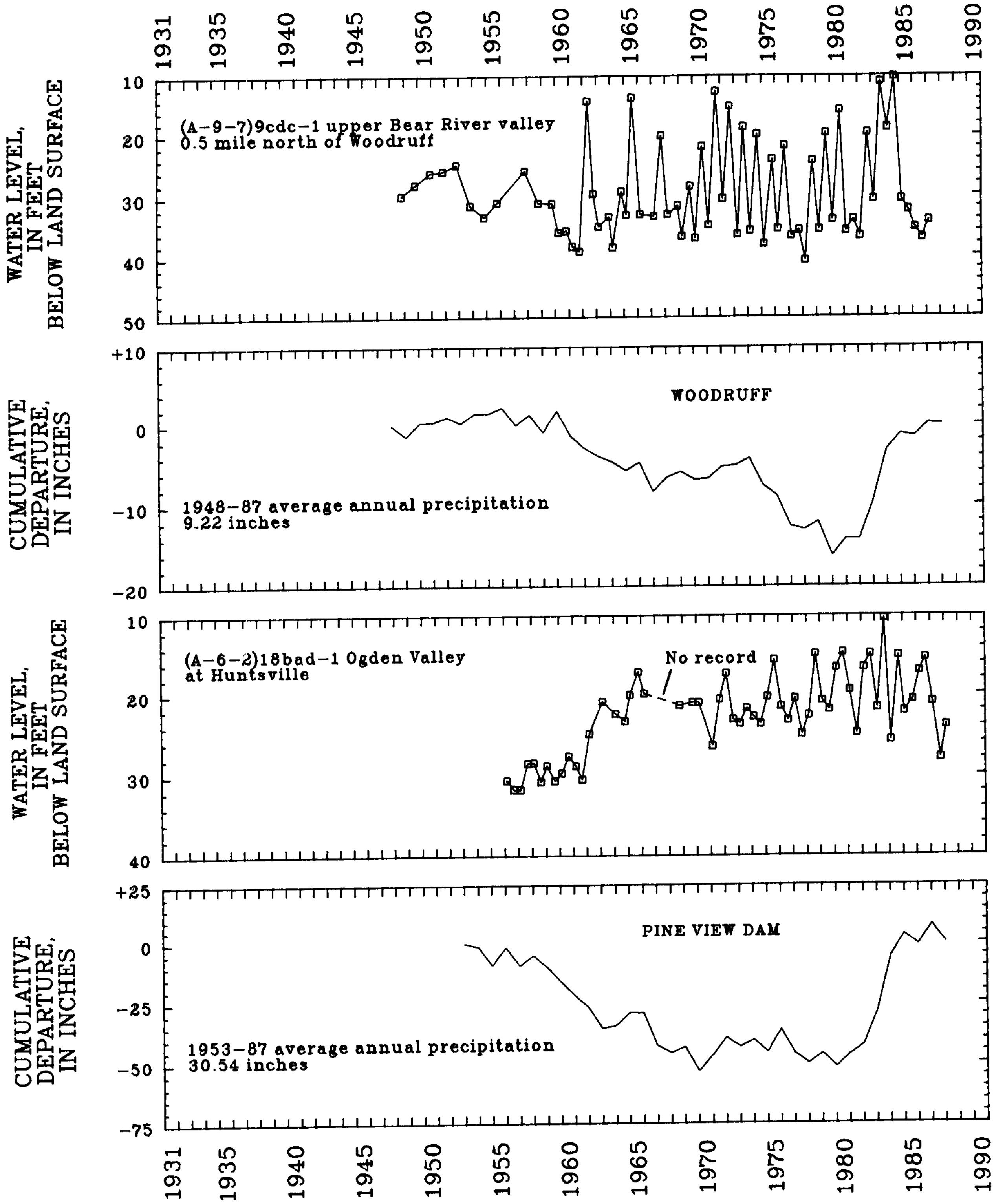

Figure 41.—Continued

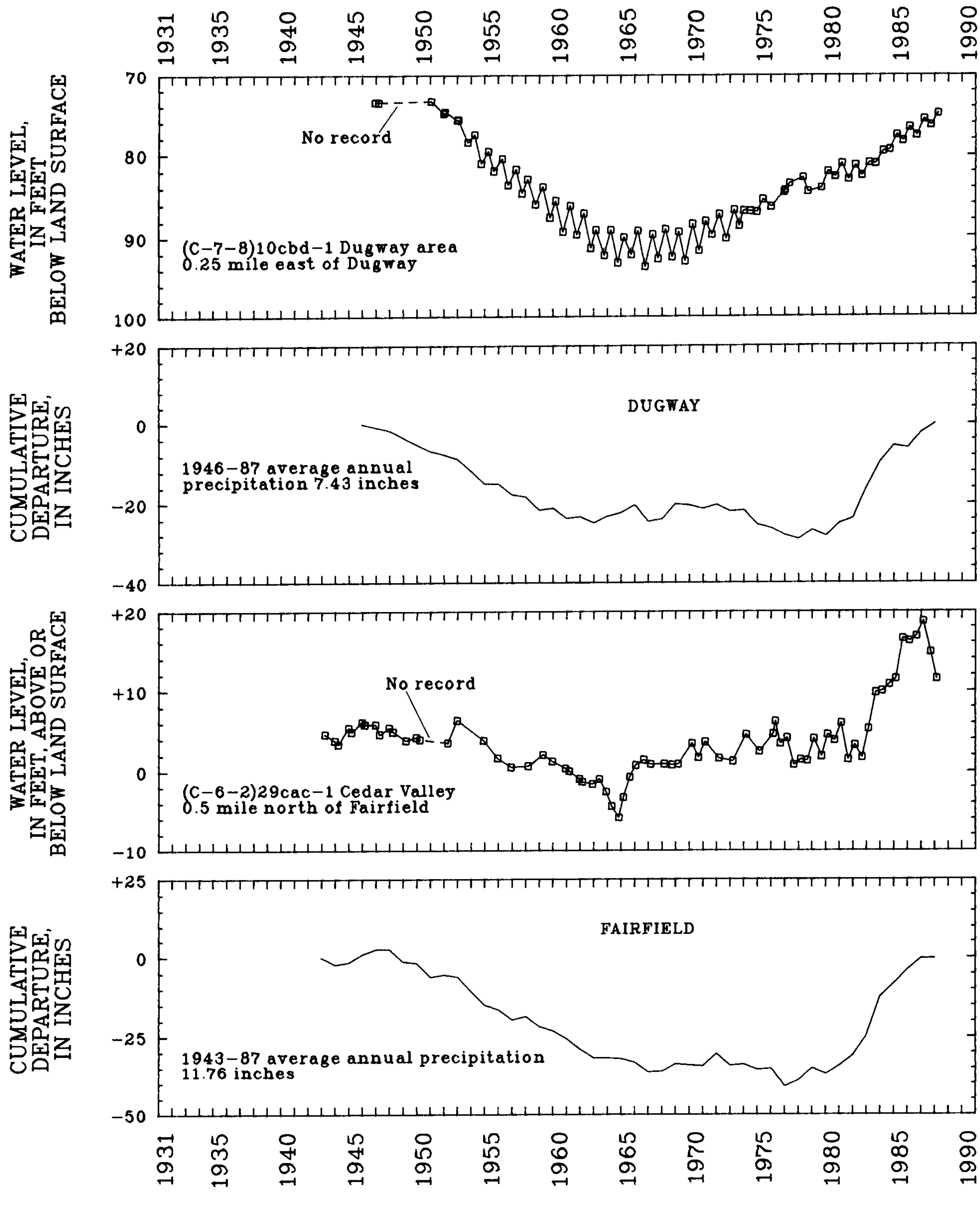

Figure 41.—Continued

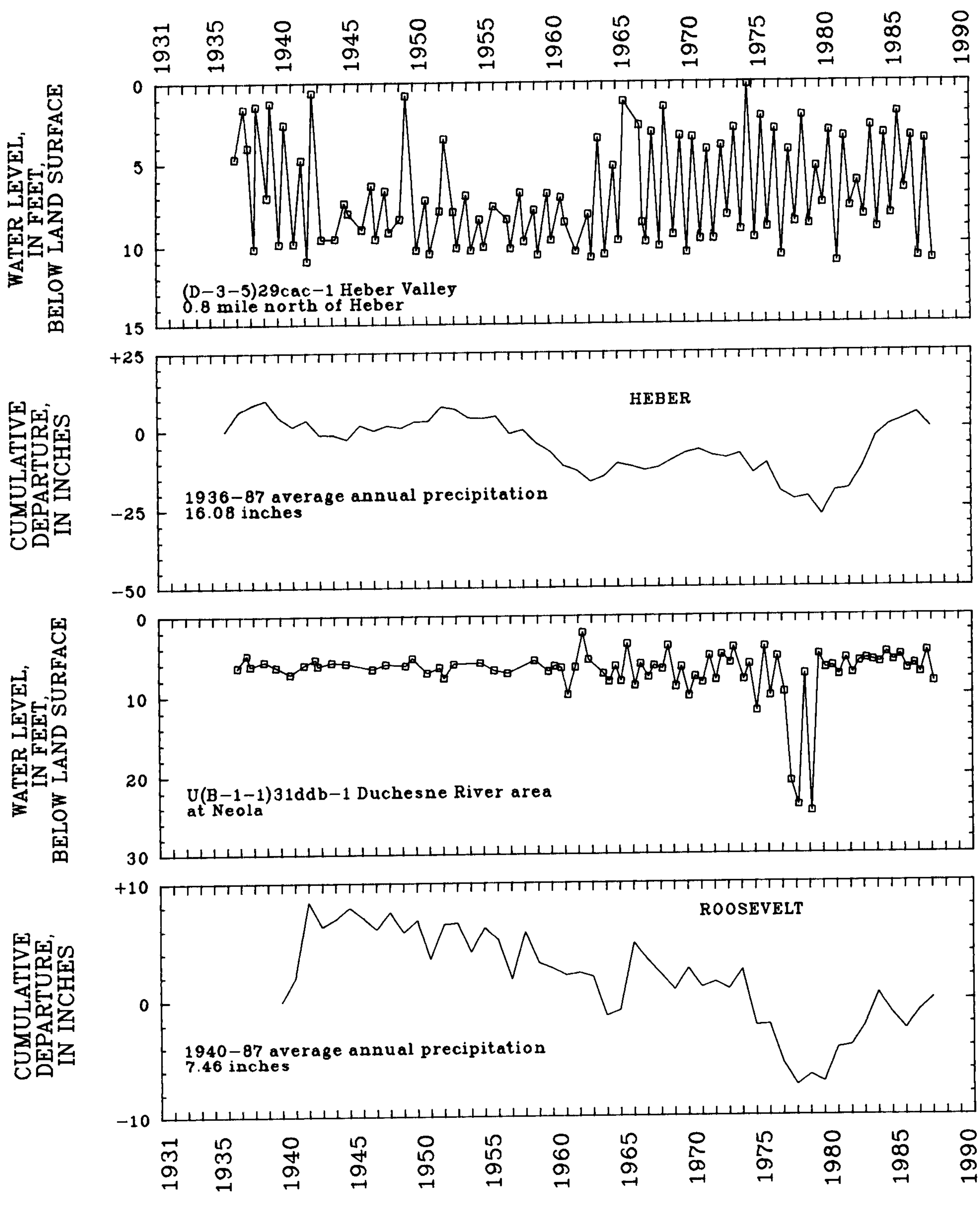

Figure 41.—Continued

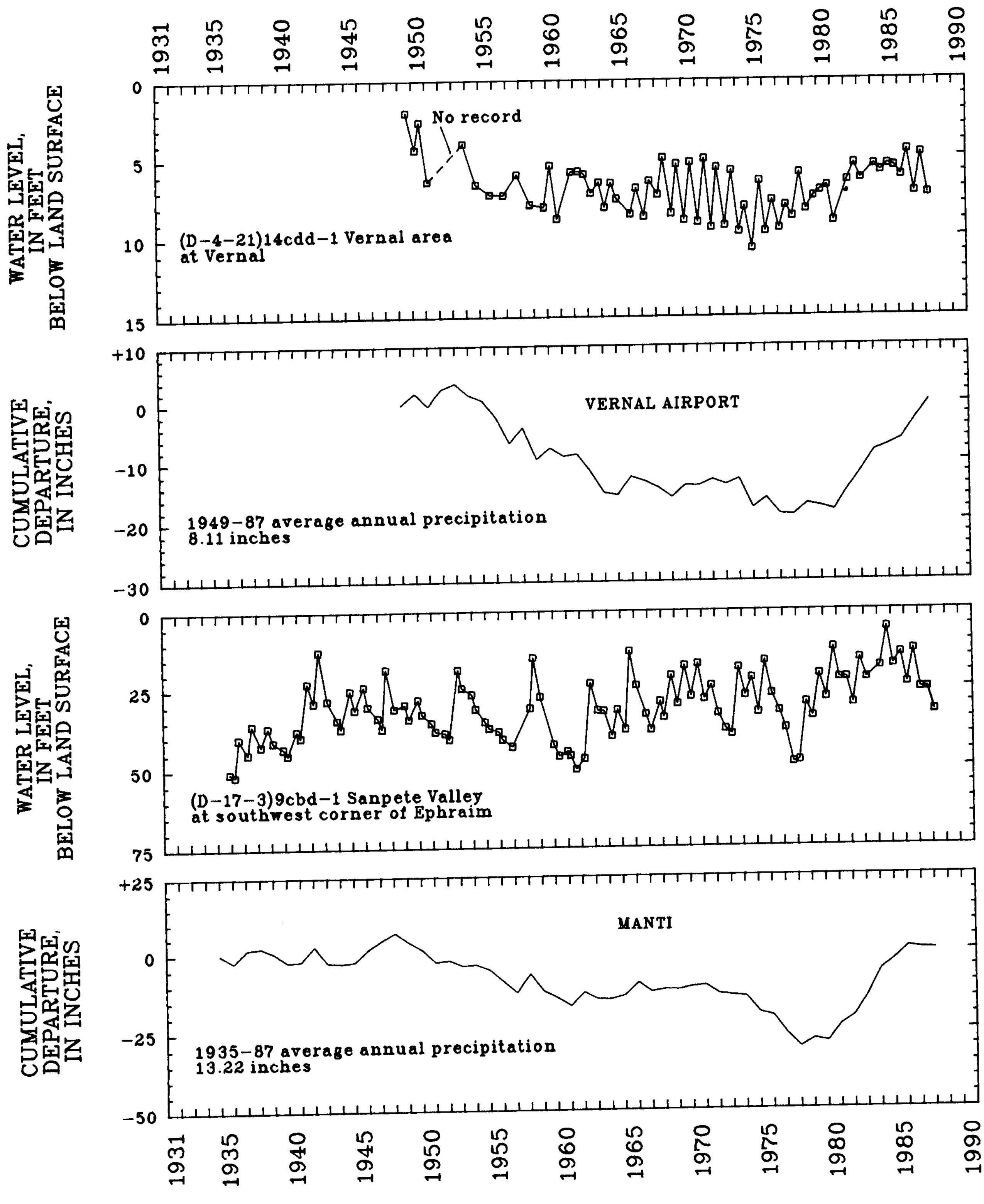

Figure 41.—Continued

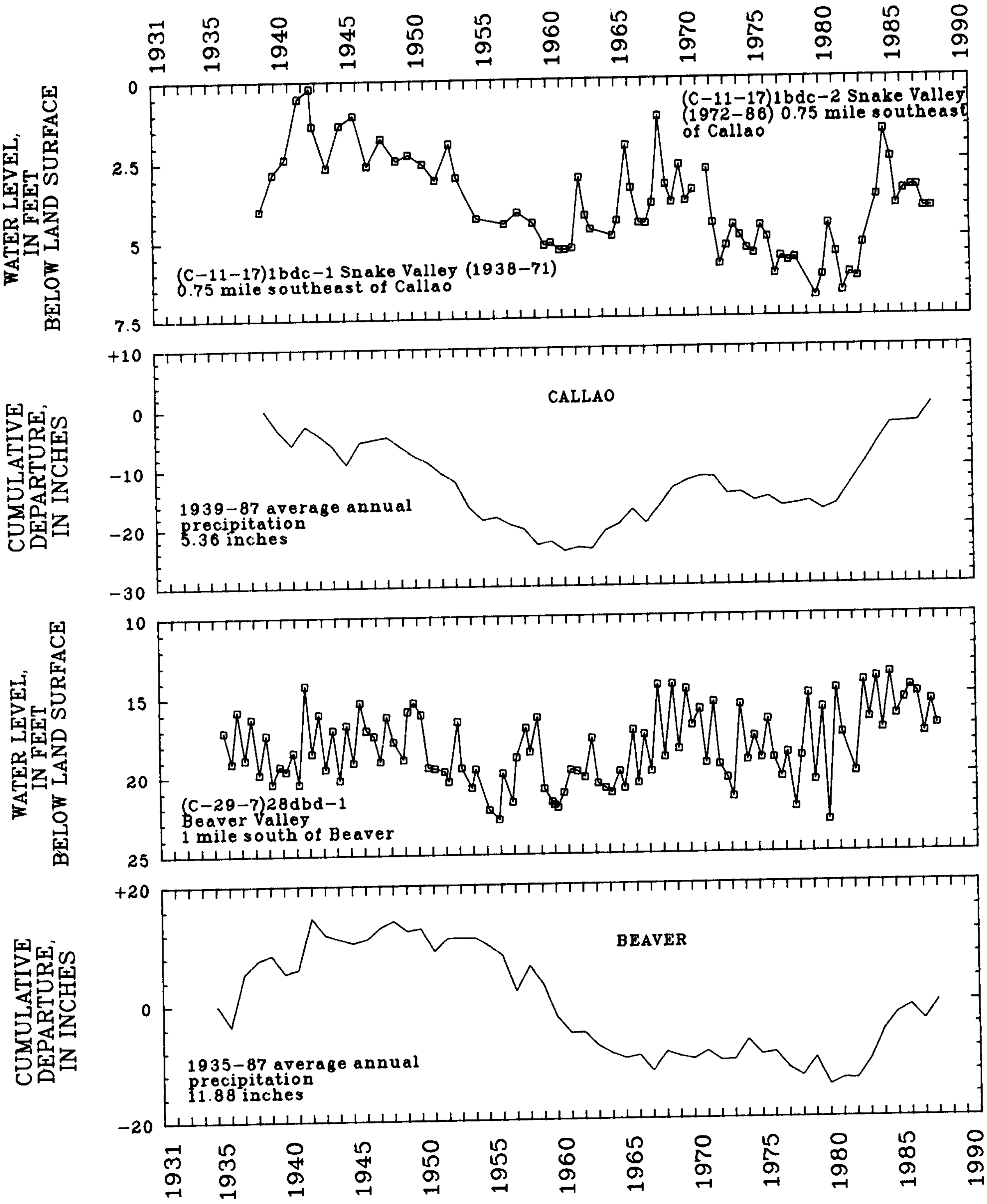

Figure 41.—Continued

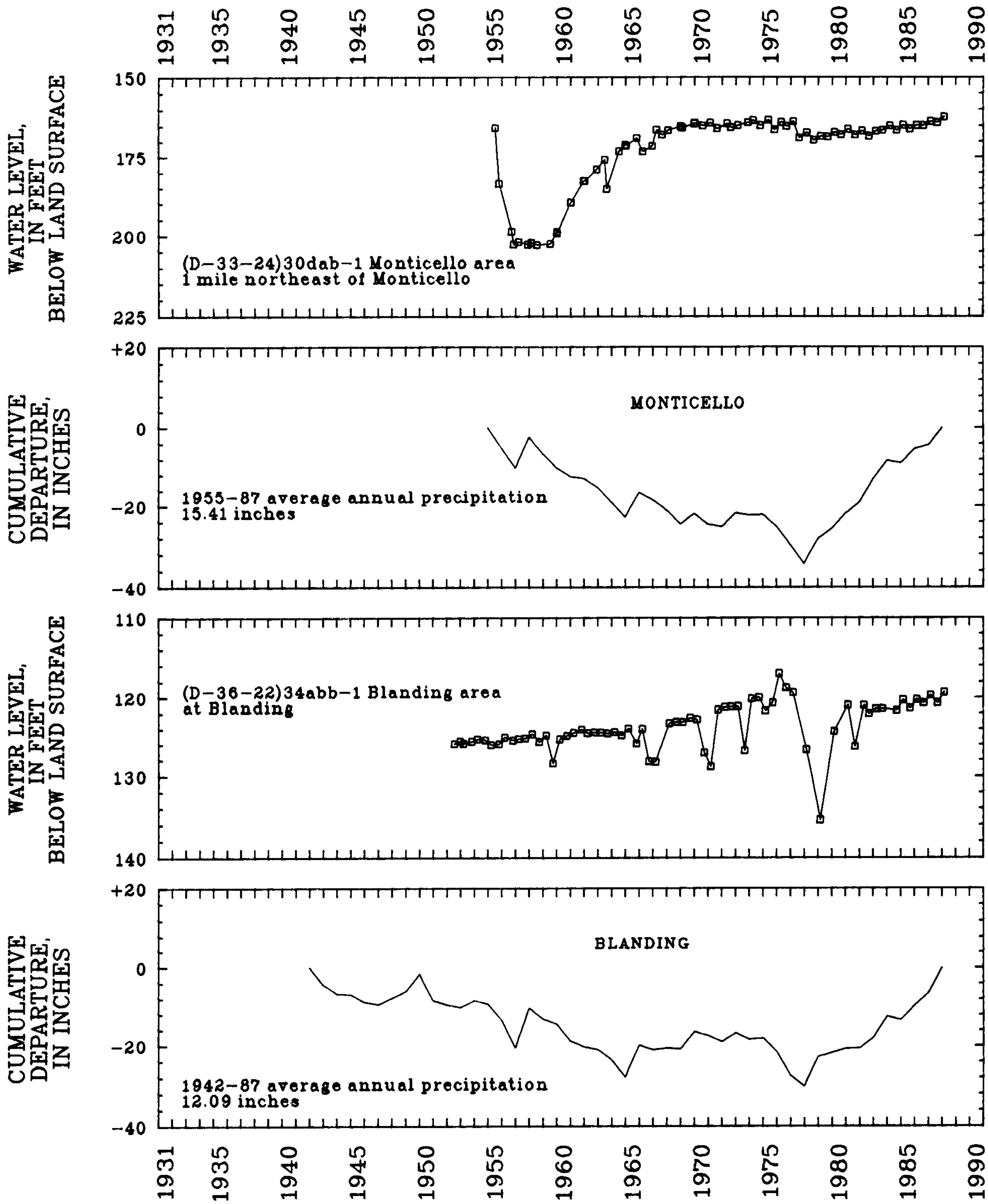

Figure 41.—Continued

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Utah
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